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Australia.

THIS week we publish an article from another of our special contributors possessing expert knowledge of a particular overseas market. Our Special Commissioner in Canada told the up-to-date electrical story of that vast and developing Dominion in the first issue of the ELECTRICAL REVIEW in January. The position in India was reviewed by Mr. J. W. Meares in our first issue in February, and we open the first March number with a plain practical statement regarding the Australian market from the pen of a student in close every-day touch with the situation, following rather appropriately upon our recent review of Mr. R. W. Dalton's report.

We suppose that there are few of the great lands of the British Empire that have been more frequently under discussion amongst us as an electrical manufacturing people in recent years than Australia. Before the war foreign electrical traders obtained a very considerable influence there, and much attention was given in these pages and elsewhere to the methods of organisation and distribution that they had developed in their competitive efforts against us. The remarkable measures taken by Mr. Hughes, the then Prime Minister, and his associates to stop anti-British penetration will be well remembered by our trade readers, as will also our difficulty of shipping goods and meeting the needs of the market. But as time passed and succeeding governments adapted the national policy to changing views and situations resulting from a state of peace, the policy of Australian home electrical and other manufacturing came increasingly into vogue. Factories of various kinds were established, but the doubt of there being a demand for Australian consumption which would be adequate to ensure profitable operation, with an economic price to the purchaser, covered the whole matter with a cloud of uncertainty. It was obvious, of course, that there never could be an Australian demand for certain lines of electrical plant production, even if it were supplemented by the requirements of what were regarded as possible Australian export markets in the Far East. While this problem of Australian manufacturing was occupying attention, British manufacturers were being criticised for their neglect of the market, but though several of our home companies took a bold course of action, there was what seemed to be a not altogether unjustifiable unwillingness to spend too great a measure of effort upon the export trade to

Australia, if the domestic policy there was to be in opposition. The many changes of government policy in recent years have naturally caused uncertainty. In our last issue we reproduced a statement of the views of the electrical manufacturers of New South Wales, expressing appreciation of the new Customs duties that have been imposed, because it is thought that they will give the electrical industry there such stability and security as will make for progress and find work for the unemployed. This new tariff has been reviewed in a number of our recent issues, and it must damp the ardour of our own manufacturing and trading concerns. As we intimated in last week's Review a large gathering of British manufacturers, including electrical, waited upon Mr. Fenton, the Australian Minister of Trade and Customs, in London, to discuss with him some of the many points of difficulty regarding trade between the two countries. It will be interesting to know whether anything practical emerged which will enable us better to judge the chances for greater development of our export trade with our blood relations. That they have their own unemployment problem, just as we have ours, must of course be recognised. Unless we act in Empire co-operation, however, it may well happen that Australian electrical productive policy may neither assist us in increasing employment at home, nor help Australia in reducing her own unemployment on economic lines. Our contributor in this issue has something to say on these matters, and we wish to direct the reader's attention to his judgment of the situation. He holds what seems to be the only reasonable view, that the question of local manufacturing will resolve itself into one of "the survival of the fittest." The situation, however, has changed materially from what it was a few years ago and the author urges upon us at home the necessity for a thorough investigation of the Australian manufacturing position. Doubtless this was one of the objects of the 130 manufacturers (including B.E.A.M.A. representatives) who met Mr. Fenton in London on February 19th.

Benefits from Export.

When proposals for interconnection at 132 kV and large exchanges of power were first mooted, there were found critics to doubt the ability of our manufacturers to meet, without the imposition of heavy development charges, technical requirements for which there was no precedent in this country.

The answer to the pessimists was given by Sir Archibald Page at the annual dinner of the Association of Supervising Electrical Engineers, when he stated that British manufacturers had never failed to provide anything that the Central Electricity Board required. It is common knowledge, moreover, that they have done so at very reasonable prices.

Without detracting from the credit due to our manufacturers for their skill in meeting abnormal conditions, such as the design of large transformers to suit the restrictions imposed by our railway loading gauge, we think it not unfair to suggest that without the experience gained in building plant for export the position would not be so happy. As Mr. V. Watlington reminded us on the same evening, 25 per cent. of the value of electrical goods produced in this country is sent overseas. This high proportion will give some measure of the extent to which consumers in Great Britain have been relieved of development charges through the contribution paid from overseas trading—an aspect of the case that is sometimes lost sight of by those who question the incidence of overhead charges, as between the home and Dominion or foreign purchaser.

Co-operation with Gas.

Sir David Milne-Watson in his recent speech to the proprietors of the Gas Light & Coke Co. referred to the serious consequences that might ensue from certain provisions of the Coal Mines Bill. He made it plain, indeed, that coal-owners had already declared their intention of using the powers conferred on them by the Bill to the prejudice of gas undertakings. This unfair discrimination would also be applied in the case of electricity supply undertakings, as Mr. W. B. Woodhouse has pointed out in our columns (February 7th, p. 277). We therefore welcome the assurance given by Mr. J. K. Brydges at the official luncheon at the British Industries Fair on Thursday of last week that the Council of the I.M.E.A. had the matter in hand and was considering putting forward, in conjunction with the gas interests, an amendment forbidding any tampering with prices to the detriment of either of the industries. This is certainly a case in which the closest co-operation between the two services is desirable in the public interest.

Additional Charges.

There is a divergence of practice among supply authorities with regard to charges for electricity supplied to consumers outside the central supply district. In some cases an additional charge is made and in others there is a uniform tariff throughout the statutory area. In adopting the recommendation of its engineer, Mr. J. N. Waite, to offer the same secondary charge of 0.5d. to all consumers, whether in or out of the city, we think the Hull Electricity Committee has been well advised. Although the competition with other methods of providing light, heat, and power may not be so keen in the less densely populated parts, it has always to be remembered that in such places, where many items which the townsman regards as essential contributors to his well-being are often non-existent, there is still the greatest of all competitors, namely, the habit of doing without things. On the other hand, the potentialities of the water heating load at 0.5d. per kWh in country districts are, as Mr. Willoughby-Ellis pointed out at Birmingham last week, capable of enormous development.

The objection to a general uniform tariff, sometimes advanced in the case of a municipal supply, that ratepayers gain no benefit from the backing of credit which they give to the undertaking is, we think, short-sighted, as the increase of load will, doubtless, react favourably on the undertaking as a whole and, therefore, to the ultimate benefit of the ratepayers themselves. With regard to Hull, we should imagine that the supply area of 160 sq. miles, including many small townships, villages, and hamlets must be one of the largest in which consumers have the benefit of a "point five" tariff. Another commendable proposal of the Electricity Committee is to abolish meter rents. These have always been most unpopular among consumers, who compare the meter with the scales used by a tradesman. It is said that the latter does not charge a rent for the use of the scales; he does, of course, but the rent is included in his overhead charges; also he does not keep one pair of scales for each consumer. The point is, however, that meter rents, even if theoretically defensible, are a source of annoyance to consumers and should therefore go, or, rather, they should be absorbed in overhead charges.

London's Electricity Supply.

In this issue we give the salient particulars contained in the report of the London and Home Counties Joint Electricity Authority for 1928/29. The area covered by this report is nearly 2,000 square miles in extent and has a population of over eight million people, the 62 power stations of the 93 authorised undertakers produce about one-fifth of the electricity generated in Great Britain. The report contains full particulars of each undertaking—technical, commercial, and financial—and details of tariffs in force as at January 1st, 1930, are included.

The growing importance of the domestic load is indicated by the fact that nearly 70 per cent. of the undertakings' revenues (excluding bulk supplies given) are derived from that source, although the sales under this category are little more than 40 per cent. of the whole. During the year tariffs for all purposes were reduced by many undertakings and the average price received in each case was appreciably less than in the previous year. Working costs were also lowered and, with the exception of a general increase in local rates, the year may be regarded as one of satisfactory progress.

Electricity Supply at Leicester.

The recently inaugurated extensions at the Leicester Corporation electricity works include a 25,000-kW turbo-alternator set and three 150,000-lb. pulverised-fuel-fired boilers.

THE first generating station erected at Leicester under the original Order of 1890 was built on the site of the municipal gas works at Aylestone, and it commenced to supply electrical energy in 1894.

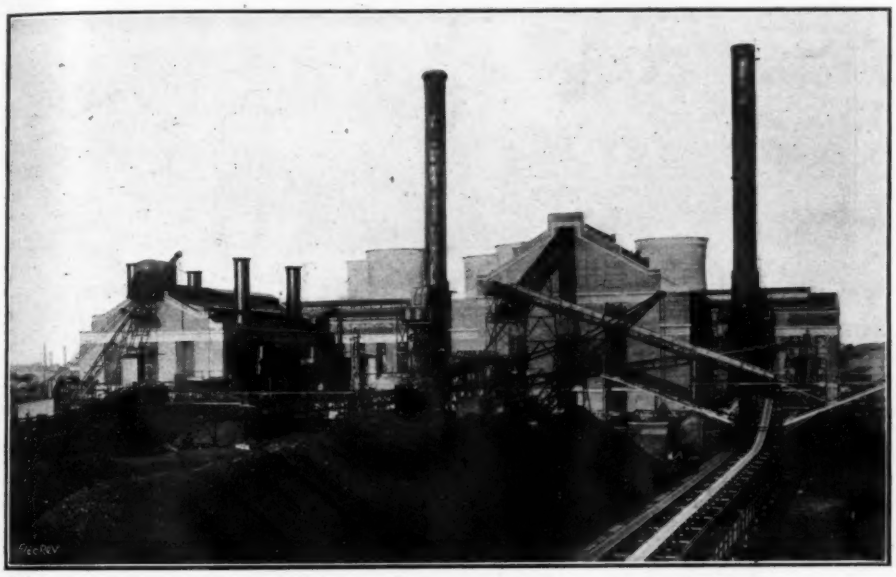


Fig. 1.—Leicester Electricity Works, showing Coal-handling Plant.

The system of generation was single-phase, 2,000 volts, 50 cycles. In 1904 a second generating station was built by the Tramway Committee in Belgrave Road, near the Abbey Park, intended originally for the sole purpose of supplying direct current at 500 volts for the City's tramways.

The present central generating station at Freemans Meadows was opened in 1922, and since that date it has supplied practically all of the energy utilised in the area administered by the City Electricity Committee. The addition of the present extensions, which were inaugurated on February 19th by Sir Andrew Duncan, M.A., chairman, Central Electricity Board, so increases the capacity of the station that it will in future be able to deal with the whole area of supply, and it is probable that the other stations will no longer be required for generating purposes.

To transmit electrical energy over the present supply area of 30,280 acres requires 500 miles of cables, while six primary and 254 secondary sub-stations have been erected and installed at various points.

The plant principally referred to in this article comprises rather more than half of the total additional capacity provided for when plans for the extension to the central generating station were prepared some two years ago. When completed, the new section of the station will contain four water-tube pulverised-fuel-fired boilers, two 25,000-kW main generating sets, two house turbo-generator sets of 1,500 kW each, and the necessary switchgear and other accessories. The buildings required to house all the ultimate equipment have now been constructed, but at present only one main and one house generating sets are installed; three boilers have also been constructed and are in operation. The contracts were placed in April, 1928. The supply of the main generating equipment was entrusted to the English Electric Co., Ltd., the house service set to the Oerlikon Co., Ltd., and the switchgear to Messrs. Ferguson Pailin, Ltd. The civil engineering work, comprising the buildings and the coal-handling and ash-disposal plant, was placed with the Mitchell Conveyor and Transporter Co., Ltd., while International Combustion, Ltd., was responsible for the design and construction of the boiler plant, and was appointed main contractor for the whole of the work, which has been carried out under the direct supervision of Mr. John Mould, A.M.I.E.E., engineer and manager of the electricity undertaking.

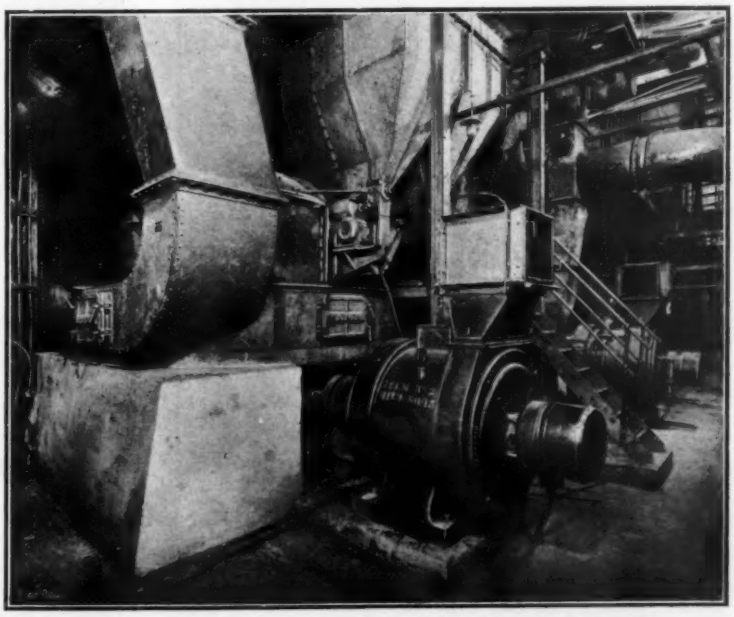


Fig. 2.—The Pulverising Mills; 15 Tons per Hour Each.

The new buildings include a boiler house large enough to accommodate four boilers, an extension to the engine room, with provision for the installation of two

25,000-kW turbo-generator sets; and extensions to the switchhouse buildings to house the necessary additional switchgear. The buildings are steelwork structures with walls of brick panelling. The new boiler house is some 95 feet long, 130 feet wide, and 107 feet high, and it is arranged at right angles to the engine room, which has been extended by 202 feet, making its present dimensions 430 feet long by 46 feet wide, and 69 feet high. New buildings, forming the control room, pump house and offices, have also been erected, parallel to the engine room, and a new structure in a remote part of the site houses the high-pressure switchgear.

The three new boilers are each capable of maintaining continuously an evaporation of 150,000 lb. of steam per hour, while an evaporation of 180,000 lb. per hour is obtainable under overload conditions. The boilers are arranged so that when the fourth unit is installed they will be grouped in two pairs at each side of the building, facing inwards; the pulverising equipment is arranged down the centre of the building. The steam-generating equipment is designed to operate normally with Leicestershire slack containing high percentages of moisture and ash. The "Lopulco" storage system has been adopted for the pulverised-fuel firing.

Four raw-coal bunkers, having a total capacity of 1,820 tons, occupy the full width of the boiler house, and are supplied by two belt conveyors. The powdered product from the pulverising mills is stored in four 45-ton pulverised-fuel bins suspended from the firing floor, so that a total of 2,000 tons of coal can be stored in the boiler house. The coal supplied to the boilers is measured by automatic coal weighers installed in the raw-coal chutes from the bunkers to the mills.

The coal-handling plant, fig. 1, has now been extended to provide the additional capacity necessary to deal with the increased quantity of coal consumed, and to transport fuel to the new boiler house. Two further "Mitchell"-type 20-ton weighing tipplers are installed on the railway embankment, adjacent to the original tippler, and each is provided with an entirely independent siding. The tipplers discharge into a common hopper from which the coal is passed by rotary feeders to either of two 550-ft. (50 tons per hour) store conveyors. A travelling wing distributor discharges from the store conveyors in two parallel heaps at either side, but coal may be transported to the ends of the store conveyors and transferred to other conveyors for transit to the new boiler house. An electrically-operated travelling crane, having an effective radius of 75 ft., is provided to reclaim coal from the store and discharge it to the store conveyors through a travelling hopper, common to both, while the old and new coal-handling systems are interconnected by a further belt conveyor, so that the two boiler houses may be supplied from either of the three tipplers.

Fig. 3.—P.F. Burners of One Boiler.

The pulverising equipment associated with each boiler comprises a mill, a cyclone separator, and an exhauster fan, with a suitable system of piping connecting the component parts. The pulverisers, fig. 2, are of the six-roller Raymond super-mill type, each being capable of dealing with approximately 15 tons of coal per hour and grinding it to a degree of fineness suitable for supplying the burners without further treatment. On entering a mill the coal is thrown up by rotating ploughs and crushed between rollers suspended from arms carried by a revolving vertical spindle and a bull-ring. While operating, there is always a layer of coal between the rollers and the ring to prevent metal to metal contact, and as a consequence the machine is almost noiseless. In order to remove excessive moisture from the powdered coal, each mill is supplied with gases at high temperature taken from the outlet duct of the nearest boiler. The hot gas entering the mill at its base through suitable ports is drawn up round the rollers and the bull-ring,

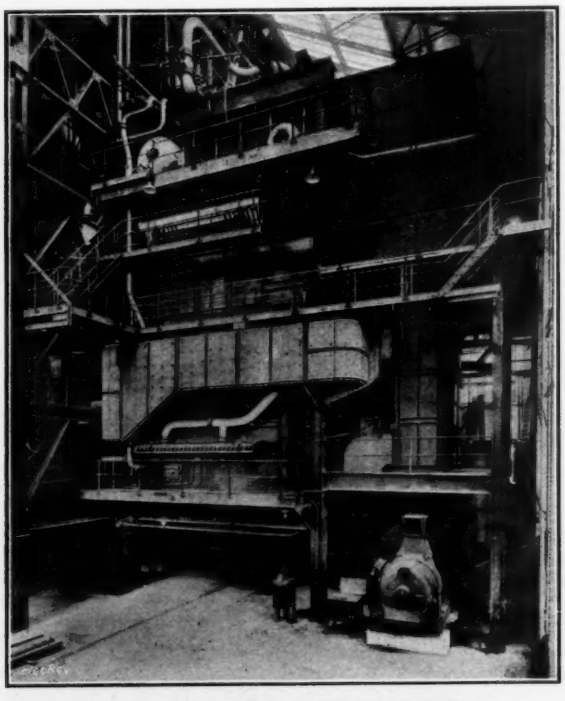


Fig. 4.—One of the "Lopulco" Boilers.

Fig. 5.—Interior of "Lopulco" Combustion Chambers, showing Burners.

carrying away particles of coal that have been ground to the requisite degree of fineness and allowing the larger and heavier particles to fall back for further grinding. At the same time, considerable quantities of free moisture are absorbed and carried off by the gas. The coal-laden gas leaves the mill through an opening at the top, and is conducted by a pipe to a cyclone separator which it enters tangentially, passing out at the top after the coal particles have been removed by centrifugal action. The pulverised fuel, after falling to the base of the cyclone, passes directly to the storage bins. An exhauster fan, connected to the top of the cyclone, draws off the gases, which are cooled considerably and heavily laden with moisture, delivering them to the front of the combustion chamber at a point below the level of the burners. Owing to the fall of pressure through the coal bed, the whole of the system from the mill through the cyclone to the exhauster fan is under vacuum, and the development of any slight leakage will cause air to flow into the system, so that under ordinary operating conditions the escape of coal dust into the boiler house is impossible.

Fig. 6.—The New E.h.p. Switchgear.

To enable a mill to operate when the adjacent boiler is shut down, a cross-connection is provided between the flue-gas suction pipe and the discharge from the exhauster, and a suitable arrangement of dampers in the three ducts permits the system to operate as a closed circuit, the exhauster returning the air direct to the base of the mill to commence a further cycle. A louvre-controlled opening in the gas duct leading to the mill permits dilution of the flue gases, and the temperature may thus be regulated to suit the amount of moisture to be removed from the coal. The powdered coal on leaving the cyclone enters a collecting chamber through a valve designed to prevent leakage of air back into the system; the coal then passes to the pulverised-fuel bin immediately below, or to a totally-enclosed screw-type conveyor. With the present installation of three screw conveyors, two of the mills can supply any of the four bunkers, while the third can only supply its own and one adjacent bunker; but, ultimately, when the fourth conveyor is added, the mills and bunkers will be completely inter-connected.

Each boiler is fired by three Lopulco turbulent type "R" burners, figs. 3 and 5, which together are capable of delivering over nine tons of coal to the furnace per hour. The burners are supplied by three sets of duplex feeders fitted at the bottom of the adjacent pulverised-fuel bin. The duplex feeder comprises two perforated plates, between which a revolving scraper in the form of a star rotates. Air passing through the feeders and carrying fuel to the burners is delivered under pressure by a primary-air fan drawing its supply from the forced-draught air chamber surrounding the burners. By making use of preheated air for this purpose, condensation of any moisture still remaining in the fuel is avoided, and consequently the coal may be readily caught up in the air current to form what may almost be considered as a mechanical gas.

Two of the new boilers are of the vertical, bent-tube, three-drum type, fig. 4, and erected above "Lopulco" water-cooled combustion chambers. The third is of a special design developed by International Combustion, Ltd., for operation with pulverised fuel. The principal feature of the last-mentioned unit is that the heating surface of the boiler is disposed around the furnace, exposing a large water-cooled area to radiant heat, so that advantage can be taken of the high flame temperature obtainable with pulverised fuel burnt under ideal combustion conditions. Further characteristics of the third boiler are the almost complete elimination of brickwork in the construction of the combustion chamber, the absence of baffles, and the freedom allowed for expansion without the introduction of serious stresses. The boilers are equipped with M.L.S.-type superheaters and designed to give a pressure of 350 lb. per square inch and a total temperature of 750 deg. F. at the turbine stop valve. In both types of boiler the side and rear walls are protected by Murray-fin tubes forming a continuous water-cooled metal screen, which absorbs radiant heat from the burning fuel and constitutes an integral part of the heating surface of the boiler.

In order to reduce the temperature of the flue gases to an economic figure, each boiler is equipped with an economiser of the Foster gilled-tube construction, comprising a group of elements each consisting of a series of tubes on to which corrugated cast-iron sleeves are shrunk, thus presenting a large cooling surface to the flue gases. After leaving the economisers, the flue gases are further cooled in their passage through air preheaters, which reduce the gas temperature to 280 deg. F. and heat up the whole of the air required for combustion

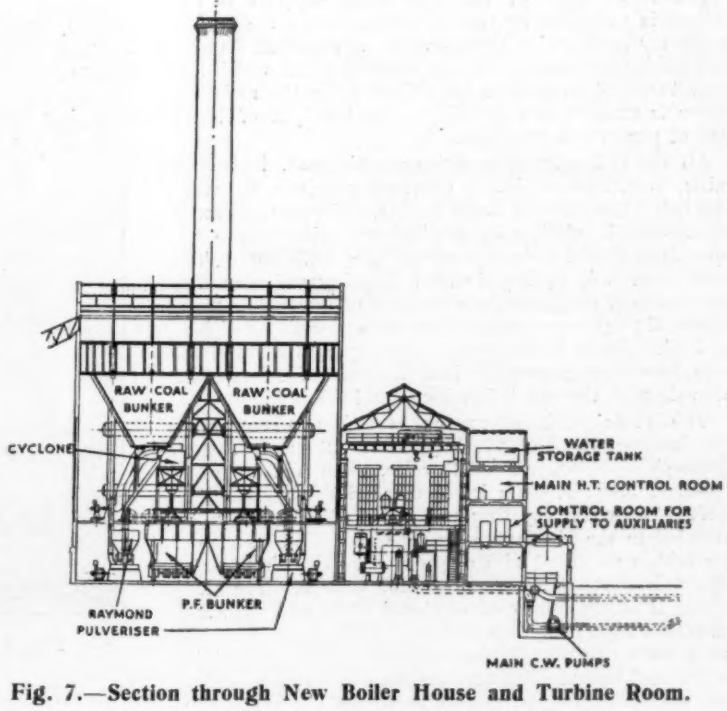


Fig. 7.—Section through New Boiler House and Turbine Room.

to a temperature of 410 deg. F. The air preheaters on the vertical-tube boilers are of the Howden Ljungström regenerative type, and that on the " Lopulco " boiler is a Usco plate-type preheater.

The mechanical draught equipment on each boiler comprises one forced- and one induced-draught fans, the former delivering air to the preheater and the latter drawing the flue gas from the preheater and delivering it to the chimney. Of the two steel self-supporting chimneys now erected, one deals with the gases leav-

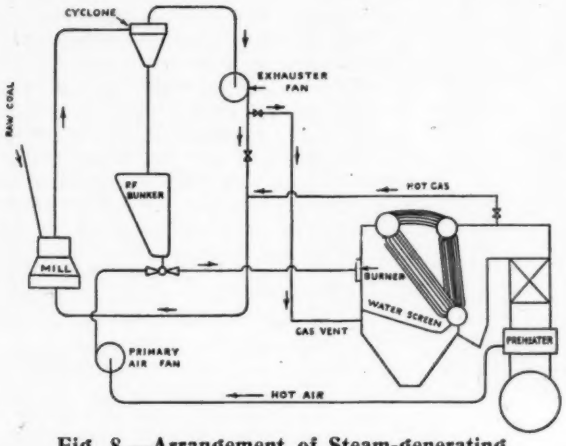


Fig. 8.—Arrangement of Steam-generating Installation.

ing the two vertical-tube boilers, and the other at present only operates with the " Lopulco " boiler, although it is sufficiently large to accommodate the fourth boiler when installed. To entrap any dust escaping to the chimneys in the flue gates, Davidson " D "-type grit arrestors are installed, connecting up to the induced-draught fan discharges. A sluicing system is provided for removing ashes from the boilers.

The main bulk of the feed water supplied to the boilers is provided by the condensate from the turbo-generator sets, and make-up water is obtained from a well sunk on the site. An evaporating plant which has been installed to remove impurities from the make-up water is capable of supplying a total output of 1,000 gal. of pure water per hour.

All the boiler house auxiliary equipment, including mills, fans, feeders, &c., is electrically driven, the starters being located close to the motors, while control panels are grouped together on a platform raised above the operating floor in the centre of the building. The boilers are fully equipped with indicating and recording instruments, enabling the operation of the boilers to be adjusted to give maximum efficiency under all conditions of load. Fig. 8 is a diagrammatic representation of the complete steam-generating installation. Fig. 7 is a section through the new boiler house and the turbine room.

The main turbo-alternator set* has a maximum continuous rating of 25,000 kW at 0.8 power factor, three-phase, 6,600 volts, 50 cycles, when driven at a speed of 3,000 r.p.m.; its economical rating is 20,000 kW. An exciter running at a speed of 1,500 r.p.m. is coupled to the alternator through reduction gear, and its field is provided with a specially graded shunt regulator for controlling the alternator voltage. The alternator is of the completely-enclosed type, and cooling is provided by a closed air circuit. It is directly coupled to a two-cylinder impulse-reaction turbine embodying solid steel rotors. The high-pressure cylinder has built-up steel diaphragms, and is arranged for single flow. The low-pressure cylinder is of the double-flow type discharging into twin condensers. At normal load the turbine is designed to operate with steam at 350 lb. per sq. in. and 750 deg. F., while a vacuum of 28.45 in. of mercury is maintained at the exhaust flange.

The condensers are of the two-pass, surface type. The cooling water is drawn from a battery of cooling towers, fig. 9, and is circulated through the condensers by means of two motor-driven pumps, each capable of supplying 26,800 gal. per minute. Duplicate " Per-vac " extraction pumps remove the condensate from the condenser and deliver it to a closed-feed heating system. Two surface-type air ejectors, one designed to operate when the turbo-generator is on full normal load, and the other at maximum continuous rating, remove vapour from the condenser and discharge it through a drip cooler to the feed heating system. Three feed-water heaters are installed in the basement of the engine room, and each is supplied with steam bled from the main turbine at a stage where a suitable temperature and pressure are present.

The house turbo-generator set has a maximum continuous rating of 1,500 kW. The generator delivers alternating current normally at a pressure of 415 volts and 50 cycles, but a voltage regulator enables the terminal pressure to be varied between 380 and 440 volts. The machine is provided with a directly coupled exciter, while the pressure is kept constant by means of a Tirrill voltage regulator. The alternator is coupled to a pure impulse-type turbine designed for the same working conditions as the main alternator. In case of emergency it is possible to start up and to run the turbine when exhausting to atmosphere. A surface-type condenser normally deals with the exhaust.

Three new cooling towers have now been provided to augment the two that previously served the original installation, so that the present battery comprises five towers all of similar design and capacity. The three new towers together are capable of cooling over two million gallons of water per hour through 12 deg. F., and the outlet temperature will not exceed 74 deg. F. under normal atmospheric conditions. The towers are of a special design developed by Messrs. L. G. Mouchell and Partners, Ltd., and consist of external re-inforced concrete shells about 125 ft. high above the pond level and 96 ft. diameter at the base.

The e.h.p. busbars of the station are now divided into four main sections, which are inter-connected by means of suitable reactors with a tie-bar and with a reserve busbar. Prior to the present extension only two bus sections existed. The new e.h.p. switchgear, fig. 6, consists of one generator control unit, and 15 units for the control of feeders, bus-couplers, reactors, &c. The equipment is of the F.P. totally-enclosed, metal-clad drop-down H.V.D. 75 type. Each switch has a

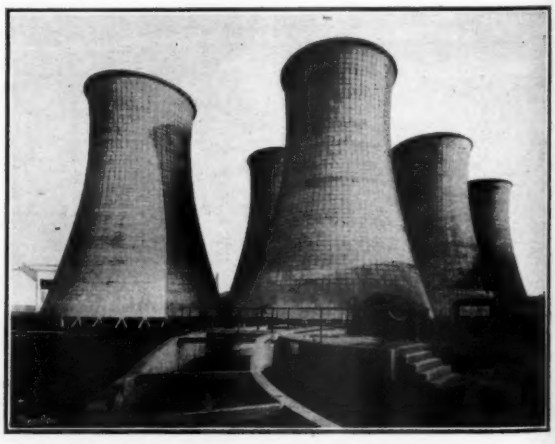


Fig. 9.—Cooling Towers and Culverts.

rupturing capacity of 750,000 kVA, and is capable of handling any fault that can come on to the station. This gear is accommodated in the new switch-house building remote from the station itself. Suitable desk-type enamelled-slate control panels are installed in the control room of the turbine house annexe, and connected by multicore cables to the switch-house. Considerable extensions have been carried out to the l.p. auxiliary switchgear, and a number of l.p. distribution switchboards have been provided at various points.

* See Electrical Review, February 21st, 1930, p. 337.

Electricity Supply, 1927-28.

An Analytical Study of the Latest Return of the Electricity Commissioners.

By D. J. BOLTON, M.Sc.(Eng.), M.I.E.E.

WHEN the previous return was issued, in June last, there were many grumbles at its late appearance and the staleness of the figures published. The volume recently issued* has gained six months on its predecessor and is a welcome move in the direction of up-to-dateness. If only this rate of acceleration can be maintained for two more returns, we shall have the figures appearing at the same time as the return of generation statistics, and within a year of the period dealt with. This must be regarded as an ideal to be aimed at, and (now that certain abnormal conditions have passed) one surely not quite impossible of achievement. If, in addition, the Commissioners would put us still further in their debt and collect some particulars of private (as distinct from public) electricity supply, instead of leaving us to glean from an occasional "Census of Production" . . . but perhaps this is too much to ask!

The year dealt with is that which terminated on December 31st, 1927, in the case of the companies, and March 31st or May 15th, 1928, in the case of local authorities.

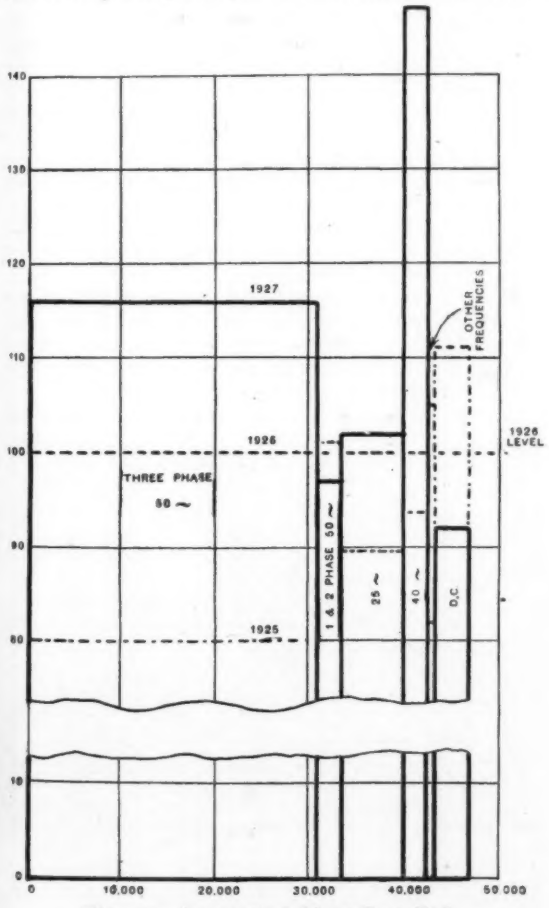


Fig. 1.—Generating Plant Installed.

In the present article it will be referred to simply as the year 1927. That year must be regarded industrially as a year of recovery from 1926, the year of the coal lock-out and the general strike. The power load (stationary in 1926) more than regained its previous rate of growth, and the price of fuel (31s. in 1926) came down to 18s., its normal price in other recent years.

In any general review of public electricity supply in this country it is important to bear in mind what may be called its double duality—of owners and of customers. On the production side this duality consists of public ownership and private ownership in the ratio of approximately two to one. On the consumption side there is the

Fig. 2.—Capital Expenditure.

duality of the two main groups of consumer, power and lighting, in the approximate ratios of three to one in magnitude and one to one in value. No great stress is here laid on the former duality, since the difference in ownership and management has almost no technical consequences, and hardly appears except in the financial results. But the latter duality, that of the two groups of users, has important results, both technical and economic, and goes far to explain the steady growth from year to year of output and receipts. When trade has been brisk the industrial load has resulted in a big increase in the units sold, whilst when there has been a slump the domestic load has come to the rescue and, although so much smaller in magnitude, has maintained the financial position by virtue of its higher prices. This point can be very well seen in the accompanying curves.

The return now issued is the fifth of its kind, covering, in all, eight years of public electricity supply in this country. As in previous articles of this nature, an attempt is made to illustrate by graphs and percentages a few of the salient figures and the progress achieved since the previous year. But in this case an endeavour has also been made to sketch in a background of the earlier years, and to see how the progress now made compares with the proportional changes registered in the past. With this in view Table I has been prepared, giving particulars based on the whole of the eight years. The first column of this table gives the percentage change of 1927 from 1926, whilst the second column gives the mean annual percentage change for all the previous years published. The latter figure is not obtained by

* Electricity Supply, 1927-28.—Electricity Commissioners: Return of Engineering and Financial Statistics, published December, 1929. H.M. Stationery Office. Price 12s. net.

taking the total change and dividing it by the time, but by working out the change each year as a percentage of the previous year and then averaging those percentages. Hence it gives a fairly true idea of the progress current in the past, and can be used as an index with which to check the present year's growth.

Thus the installed capacity in generating stations of authorised undertakers (item 1) increased during 1927

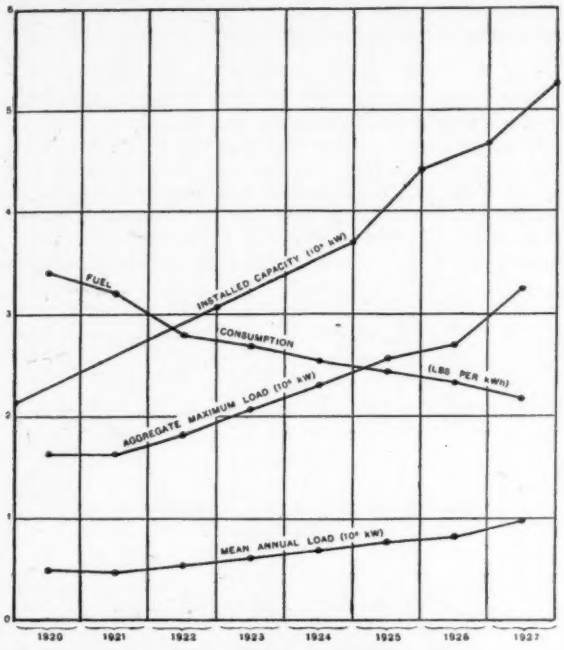


Fig. 3.—Mean Station Performance.

by roughly the same figure as in previous years, namely, 12 per cent., whereas the aggregate maximum load on the same stations (item 2) increased by nearly 20 per cent., more than double the usual increase. As a result the amount of plant in excess of the maximum demand went down from 73 to 62 per cent., a notable and welcome reduction, although the figure is still very high. The total output from these stations (item 4) also went up more than twice as much as the mean of previous years, leaving the load factor (determined by the ratio of items 2 and 4) unaltered at 30 per cent. A final item on the generation side, that of fuel consumption per kWh, achieved as usual an appreciable reduction.

TABLE I.

Item.	Change from preceding year.	Mean annual change in all previous years.
1. Installed capacity.	Increase of 12.3%.	+11.5%.
2. Aggregate maximum load.	Increase of 19.8%.	+ 8.9%.
3. Excess plant (items $\frac{1-2}{2}$)	62% from 73%.	
4. Total kWh generated.	Increase of 20.9%.	+8.9%.
5. Mean load factor.	No change from 30%.	
6. Fuel consumed per kWh.	Decrease of 7.3%.	− 6.1%.
7. kWh sold (lighting and domestic).	Increase of 18.4%.	+17.0%.
8. Revenue from ditto.	Increase of 13.1%.	+ 7.8%.
9. kWh sold (power).	Increase of 20.4%.	+ 8.1%.
10. Revenue from ditto.	Decrease of 0.9%.	+ 3.0%.
11. Mean price per kWh.	Decrease of 11.9%.	− 6.3%.
12. Surplus of receipts over expenses, per cent. of capital expenditure.	This year, 8.7%.	Previous years, 8.7%.

Coming now to the selling end, those faithful customers the lighting and domestic group maintained their steady increase of something under 20 per cent. in magnitude. Prices fell rather less than usual, so that the revenue from this group increased by 13 per cent., nearly double the average of past increases. The power group is, of course, a more fickle one; this year the increase in magnitude was over 20 per cent., but, owing to price reductions consequent chiefly upon the reduced cost of coal, the income from this group actually declined slightly. Both these figures are, however, in the nature of a recovery from the industrially abnormal year of 1926, when the power consumption was stationary whilst the income from it went up very considerably.

Finally, taking the economic and financial results of the year as a whole, it will be found that an increase in output of about 20 per cent. was accompanied by a reduction in mean price per kWh of 12 per cent., giving a net increase in revenue of 5½ per cent. The excess of receipts over working expenses, which was available to pay all capital charges, came to 8.7 per cent. of the capital expenditure; this was identically the figure averaged in previous years.

The accompanying diagrams are an attempt to illustrate graphically some of the more salient points in the above figures. They are taken as far as possible in a logical order, starting with the plant installed, proceeding with the loads, sales, and prices, and concluding with the financial results. Fig. 1 shows the types of generating plant existing at the end of 1926 (level dotted line) and the plant installed during 1927 (areas above and below that line). The areas represent kW in each case, but in order to exaggerate the changes for the year the vertical distances are foreshortened. As an additional guide, the 1925 figures are indicated also (chain dotted lines). It will be seen that whilst standard gear predominates there is an appreciable amount of 25-period plant and lesser quantities of d.c. and 40-period. Of the increases during the year most of this was of 50-period (half a million kW) but there was a big proportional rise in the 40-period plant (100,000 kW) this being accounted for by the inclusion of plant in the North Tees station. The other non-standard groups have all declined in size, with the exception of the 25-period one, and even in this case the increase has not been great.

The next step is to examine the capital expended, not only on this generating plant but also on all the other items in the supply system, and this is set out in fig. 2. The area of the dotted circle indicates expenditure at the

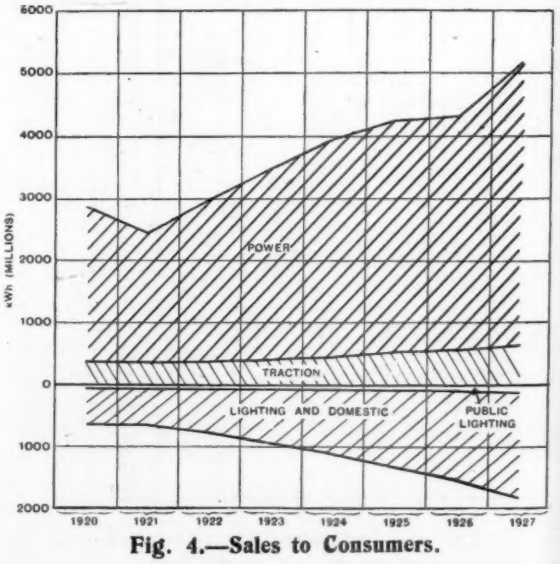


Fig. 4.—Sales to Consumers.

end of 1926, and this is divided up by angles representing the different objects of expenditure up to that date. The full line sections represent 1927, so that the areas outside the dotted arcs represent the expenditure during that year. An earlier year has also been indicated (chain dotted arcs), in this case 1924, so as to show the change three years back. It will be seen that generation accounts for appreciably less than half the total expendi-

ture, and the proportion grows smaller year by year. The biggest proportional increases were in the smaller items, " main transmission " and " motors and miscellaneous," the latter increase being probably due largely to the adoption of hire and hire-purchase trading by a number of authorities.

The third diagram gives an outline of the mean station performance since the returns first began to be issued. The three rising curves plot mean load, aggregate maximum load, and installed capacity, respectively, and all show a uniform and steady increase. The ratio between the first and second of these, representing the mean annual load factor, has remained almost steady at 30 per cent. throughout. The topmost curve, since it represents the capacity at the *end* of the yearly periods, is plotted at slightly different abscissæ points. The dots in each case represent actual figures from the different returns. On the same graph has been plotted the coal consumption per kWh, and this has fallen just as steadily as the others have risen. A further point on this curve could be put in from the recently published returns of generation particulars for 1927-8, and would show a further decrease to 2.05 lb. per kWh.

The next diagram, fig. 4, shows the sales to consumers. In order to distinguish as clearly as possible the two main groups, a horizontal zero line has been drawn in the middle of the figure, lighting and domestic consumption being plotted below this line and power and traction above it. Approximately one quarter of the total consumption is for lighting, the remaining three-quarters being for traction and power. The lighting load has advanced steadily, but the power load shows two checks, a serious one in 1921 and a slight depression in 1926. Taking the six years that elapsed from the slump of 1921 to the last year published, the sales have more than doubled and now stand at approximately 158 kWh per head of population.

The next point to consider is the money obtained for

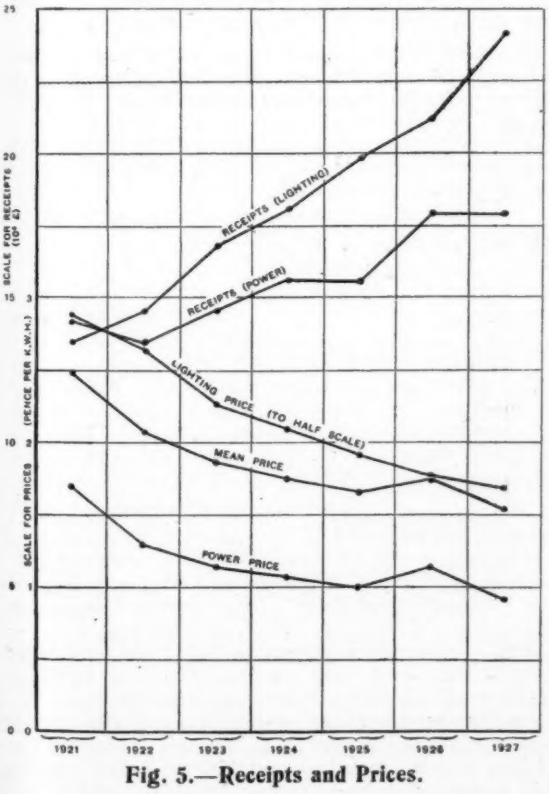


Fig. 5.—Receipts and Prices.

all these units. The upper two curves in fig. 5 show the receipts from the two main groups, and it will be seen that the domestic is now appreciably the bigger contributor to the supply exchequer. Moreover, in the last year it showed a further increase, as compared with a set-back in the power receipts. These receipts are the combined effect of the number of units (dealt with above) and the price per unit shown in the three lower curves of this figure. These prices indicate a steady reduction, interrupted only by the rise in 1926 due to the increase in fuel prices.

The final diagram (fig. 6) shows the results of the year's working, omitting the energy bought and sold in bulk. The area of the inner (dotted) circle represents the total receipts from the sale of energy to consumers in 1925 (that year has been chosen in preference to 1926 because

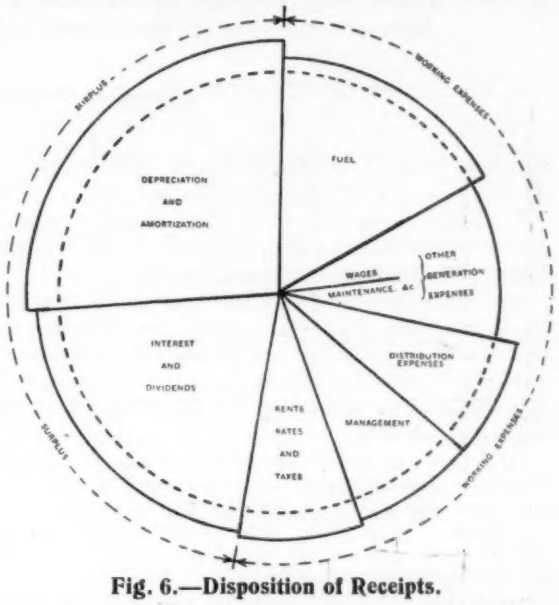


Fig. 6.—Disposition of Receipts.

the latter was abnormal, particularly as regards fuel costs). This area is then divided up by angles to show the destination of these receipts. The full sectors represent 1927, so that the outer areas show the growth in two years.

The division is first made into two main groups, working expenses (right-hand side) and surplus available for capital charges (left-hand side). It will be noted that the management and other expenses are placed among the former, being (at least in municipal finance) in the nature of salaries rather than profits. These working expenses are then further divided up into fuel and other generation costs, distribution, management, rates, &c. It will be noted that fuel represents almost one-third of the working expenses and exactly one-sixth of the total revenue. The other generation expenses (comprising wages, repairs, &c.) account for two-thirds as much as the fuel, and the remaining working expenses, namely, distribution, management, and taxes, each accounts for half as much as the fuel. Of the increases registered since two years previously, the rents and taxes item shows the largest proportional increase and the various generation expenses the smallest.

The left-hand side of the diagram, comprising just under half the total receipts from the sale of energy to consumers, represents the surplus of income over working expenses. This is divided up into two portions, representing what may be called " disbursements " and " replacements." The former is made to include all interest and dividend payments, contributions to rates, or other allocations which can be regarded as having been paid away. In the latter is placed sinking fund, depreciation, and reserve deposits, and any capital expenditure made from current accounts. It therefore represents the amounts saved from current working to meet future liabilities in the way of depreciation and obsolescence. Taking a mean of public supply as a whole, this replacement portion is slightly the larger of the two, but this mean is not really very informative since two sorts of management (municipal and company) are concerned, with somewhat different policies. The actual value of the surplus, if reckoned as a percentage of the capital involved, is practically the same in the two cases, but the disposal of this surplus is of course very different. In the case of the local authorities just over two-thirds of it goes into the replacement group, whereas with the companies the figure is only 42 per cent.

Australian Electrical Market.

The author, who reviewed the situation eight years ago, now deals with developments that have occurred during that period, and discusses factors that are now operating.

From A SPECIAL CORRESPONDENT.

In the Electrical Review dated April 7th, 1922, (pp. 475 to 477) the writer contributed an article dealing with the Australian electrical market generally. He considers the present to be a suitable time to bring his previous examination up-to-date.

The former article was written at a period of almost world-wide depression following upon the collapse of the post-war boom, and the present one has been written during an Australian financial and general commercial depression which exceeds by far anything within the writer's recollection.

Whilst the new Federal Labour Government is seeking to reduce unemployment by various methods, it is retrenching where possible, *e.g.*, by drastic reductions in the Defence Department. Most State Governments are cutting down expenditure in all directions, thanks to the paucity of loan moneys.

Wool prices are, in comparison with those of recent years, alarmingly low. It is a commonplace remark in Australia that the country is carried on the sheep's back, and the uninformed reader in Britain may not always realise how the prosperity of Australia depends upon satisfactory wool prices.

The current season's wool sales were being conducted while this article was being written and the prices realised were considerably below those of last year. It is estimated that, compared with the preceding year, Australia's wool income will be £20,000,000 lower, which figure may serve to emphasise what Australia is facing.

Grave labour disputes have also had their effect. The timber workers declined to observe a Federal Arbitration Court award and were on strike for the greater part of 1929, whilst the most important coal field in Australia was shut down for almost the whole of the year. Loss of life occurred in riots, and at the time this article was being written the mines were not working.

The Nationalist Government was defeated on the question of the Federal Arbitration Court, having gone to the country on the question of abolishing this Court, except with regard to one or two industries which were definitely Federal in character, such as maritime workers. The Labour Government now in power claims to have its remedies for dealing with the present grave unemployment, but a hostile Senate may affect its plans unless, as appears likely, there is another election for both Lower and Upper Houses shortly.

Eight years ago the writer expressed the opinion that the outlook for British electrical manufacturers in Australia was bright, stressing the need for sound and efficient organisation to recover the markets lost during the war; that those remarks were then justified is apparent by comparing the imports, the figures for which are quoted below. These figures were gleaned from the Customs Department returns for the year July 1st, 1919, to June 30th, 1920, that being the last year dealt with in the earlier article, and for the year ended June 30th, 1928, the last one for which figures have been published by the Customs Department.

(A) *Dynamo Electric Machines.*

	Year 1919/1920.	Year 1927/1928.
United Kingdom	£327,318	£661,390
U.S.A.	381,440	169,102

For the year 1919/1920, the Customs' classification included under the broad heading "Dynamo Electric Machines" static transformers, induction coils, and electric fans, all of which were excluded in the year 1927/1928. Turning to the static transformer figures for that year we find:—

United Kingdom	£128,146
U.S.A.	21,101

(B) *Starting and Control Apparatus, including Switchboards.*

United Kingdom	£47,668	£206,332
U.S.A.	73,019	105,573

(C) *Accumulators or Storage Batteries.*

United Kingdom	£44,520	£266,238
U.S.A.	77,038	409,539

The foregoing three groups were mentioned in the earlier article and the figures are reasonably satisfactory in general, although it will be seen that the American proportion of accumulator imports has increased considerably more than that of the British; this is due, in part, to the preponderance of American motor cars in Australia. The proportion of British cars coming into Australia is, however, slightly increasing.

In addition to these three groups, the following import figures will be of interest, some indicating where the British maker has yet to make up considerable leeway:—

(D) *Lamps.*

	Year 1927/1928.
United Kingdom	£299,563
Holland	180,578
U.S.A.	52,282

(E) *Instruments.*

United Kingdom	£80,778
U.S.A.	44,725
Switzerland	17,561

(F) *Heating and Cooking Apparatus.*

United Kingdom	£27,501
U.S.A.	42,504
Canada	14,456
Germany	10,217

(G) *Vacuum Cleaners.*

United Kingdom	£19,053
U.S.A.	68,635
Germany	59,504
Sweden	42,222
Canada	15,469

The opinion was expressed in 1922 that local manufacture was likely to be overdone, but it is difficult to claim generally that the prophecy has been borne out; certainly the Australian sentiment in favour of local manufacture is stronger than ever and recent tariff revisions may be classed as prohibitive. A few instances will suffice. Switchgear is now dutiable at 65 per cent. British, or 75 per cent. foreign. Alternating-current motors from 1 h.p. to 125 h.p. pay duty under that one of the two following classifications which returns the higher duty:—

(*a*) £5 per motor plus 15s. per h.p., or

(*b*) *ad valorem* 45 per cent. British, or 60 per cent. foreign.

Transformers have been severely dealt with, as will be seen by the following :—

Up to and including 25 kVA, £2 10s. per kVA.

Above 25 kVA, but not exceeding 150 kVA, £1 5s. per kVA.

Above 150 kVA, but not exceeding 500 kVA, 15s. per kVA.

If, however, 60 per cent. British, or 75 per cent. *ad valorem* returns the higher duty, these are to be charged.

Over 500 kVA, 60 per cent. and 75 per cent. *ad valorem*.

In many instances the British preference has been reduced.

New factories are constantly being started, some sponsored by British and American parent companies. In the earlier article a report by Mr. Ferrin, late American Trade Commissioner, was quoted on the possibility that large American manufacturing concerns might establish plants in Australia; this has happened. At the same time, there are indications that, as in most fields, this matter of local manufacture will resolve itself into a question of the survival of the fittest.

Some of the more prominent manufacturers of electrical plant and apparatus include induction motors (three or four makers), traction motors, starting and control gear, static transformers (about five makers), refrigerators, radiators, stoves, irons, kettles, conduit and fittings; some of these plants carry out ambitious contracts, but the turbo-alternator programme referred to in my 1922 article has been dropped.

In that article mention was made of the, at times, harassing regulations which the local maker has to face, and with the passing of the years these have tended to increase.

When the present wave of depression has passed it is confidently claimed that Australia will go forward to still greater developments.

The State Electricity Commission of Victoria has practically covered the whole of its area with its transmission lines; a similar commission is at times mooted for New South Wales, and while, at present, nothing definite is being heard of it, the opinion is current that it will not be long postponed, especially if, at the next State elections, the Labour Party should regain power from the present Nationalist Government. The latter is expected to deal with the matter early next year if time permits.

The generation and supply of electricity in Australia is regarded as essentially a public utility, and, as such, is almost invariably in the hands of Government or municipal concerns.

A former N.S.W. State Labour Government passed an Act requiring that local municipal councils should give 10 per cent. preference in favour of Australian manufacturers other things being equal; the sentiment in Australia appears to be very much in favour of importing from Britain where Australian manufactures are not procurable (except in the case of cars and films, with which this journal is not concerned).

In 1922 reference was made to the hold which Japanese electrical manufacturers secured on this market during the war, but it was prophesied that this state of affairs would quickly change, and this has been the case.

In my previous contribution the opinion was expressed that the tariff would be increased, and this has proved to be substantially correct. The Nationalist Government revised the tariff a few years ago and the new Labour Government has recently drastically increased the tariff schedule in some cases to such an extent as to render the new protection prohibitive.

The figures quoted above of Customs' returns for the year ending June 30th, 1928, are compiled by the Commonwealth Statistician and appeared in the Overseas Trade Bulletin No. 25, a copy of which may be inspected by interested parties at Australia House; possibly, by the time these notes appear the figures for the year ended June 30th, 1929, may be available.

To sum up, the outlook for the British maker of electrical plant and material in Australia is not nearly so satisfactory as it was a few years ago. That it will revive somewhat when the economic position in Australia has improved is certain, but the old conditions have passed and those British companies which are not prepared to investigate the question of manufacture in Australia must face the inevitable, while one would hesitate generally to recommend the adoption of local manufacture, save in certain specialised lines where inordinate competition is unlikely.

Rubber Conveyor Belting.

Notes on the duty, life, and capacity of belting of different types.

By THOS. W. FAZAKERLEY.

RUBBER belting possesses an adaptability and functioning power that, generally speaking, is absent in other types of conveying agents.

At the present time there are three types of rubber belts on the market, all of which are useful in their respective spheres.

(1) *Transmission.*—Generally made in small width (up to about 10 in.) and in continuous lengths up to 1,000-ft. (or more). The basis can briefly be described as a strong cotton heavily impregnated with rubber solution, folded in *one piece* into the number of plies and width required, and subjected to a powerful vulcanisation and pressure combined, by means of steam heated steel plates. It is generally used for pulley or transmission work.

(2) *Balata.*—Made in a similar manner to transmission, but the cotton is impregnated with a solution of Balata (gum from the " bully " tree) and is sold in the same sizes and lengths. It is used under more exacting conditions than transmission, and is generally used in a factory where it comes into contact with pungent atmospheres or grease, &c.

(3) *Conveyor.*—This type is generally made in large sizes for actual conveyor work—the average size being in the region of 150 ft. long, 20 in. wide, and 5-ply thick. It is made by the adhesion of plies of cotton soaked in rubber solution, and a thick layer of solid rubber is finally wrapped in the form of a jacket round them; the thickness of the covering is generally $\frac{1}{8}$ in.

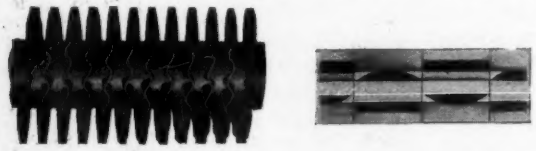
Life and Capacity.—The tendency appears to be to run belts at a slower speed than ten years ago. This practice is a material factor in prolonging the belt's life, but there has always been a considerable difference of opinion as to the correct formula to use in estimating the life of a belt. The formula often used by estimating offices is as follows :—Tons carried = 500 × width of belt^2 × pulley centres/100. The formula for estimating belt capacity can be taken as follows : (width of belt)^2 × (speed) × (weight per cu. ft. of load carried)/70,000.

Horse-power.—There is again a considerable diversity of opinion regarding the requisite horse power needed to run different types and size of belts. It should be remembered that, whilst a comparatively small horse power will keep a belt running under normal working conditions, it may require three times the original power to start the same belt carrying (for its size) an abnormal load under the same conditions.

Electricity for the Home.

Further notes on selected domestic electrical appliances exhibited at the British Industries Fair, Birmingham, depicting the trend of modern development.

As was the case with the cookers displayed at the British Industries Fair at Castle Bromwich during the past fortnight, electric fires were shown in all manner of coloured-enamel finishes on practically all the domestic-appliance manufacturers' stands. A further innovation seen at several of the exhibits was by way of a variety of chromium-plated finishes, some excellent examples of which were shown by Revo Electric Co., Ltd. Perhaps the most interesting, or at any rate attractive, feature of some of these is the rounded corners of the framework, which, while designed to give protection to the chromium plating, add to the beauty of



Figs. 1 and 2.—Construction of " Maxheat " Tube and Element.

the apparatus by virtue of the graceful outlines. Fig. 3 shows the " Victor Dome " fire which was seen amongst a range of light and portable appliances on the stand of the Edison Swan Electric Co., Ltd. This fire can be supplied in standard finishes of oxidised brass, copper or silver, and the loading is 2.25 kW. Some of the fires are exceptionally light, and a common feature is the

Fig. 3.—The " Victor Dome " Fire.

vertically arranged elements. This design provides for quick heating at the floor level in the absence of reflectors, which, of course, make the appliances heavier.

As we get nearer to the solution of the problem of electric heating in its broadest sense, so, presumably, we must get away from the idea and design of the present orthodox fire. Low-temperature heating is, no doubt, one of the most promising schemes in vogue, and Messrs. Young, Osmond & Young, Ltd., and The Wardle Engineering Co., Ltd., had some interesting examples of equipment under this heating. The " Maxheat " system of the latter company is claimed to be an advance on the conventional tubular apparatus, in that the area of radiation is increased about five times by virtue of a spirally arranged fin around the tube as indicated in fig. 1. The centrally arranged element is threaded

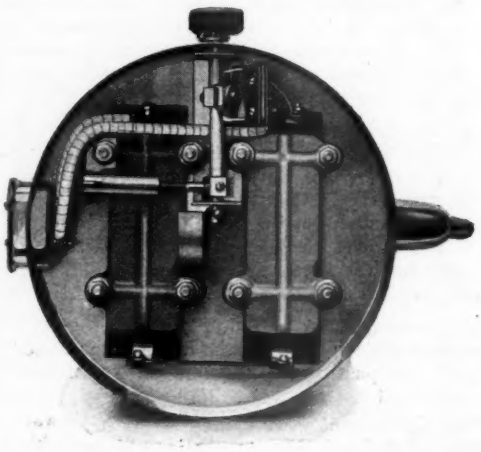


Fig. 4.—" Safety " Equipment of " Carron " Kettle.

through fire-proof porcelain units mounted on a steel core, see fig. 2. These " Maxheat " tubes are supplied in lengths of from 2 to 14 ft., and in loadings of 150, 200, and 250 W per ft. run of tube. Two fixing brackets are supplied with each tube, and also either a standard bushed end cap or a gas-tight end cap tapped for ¾-in. side entry.

The most interesting of recent developments in connection with electrical water-heating apparatus are probably those governing the hot-water delivery, as depicted by apparatus exhibited by Messrs. Charles Joyner and Co., Ltd., and by Berry's Electric (1928), Ltd. In the " Angelus Instanter " water heater of the former com-

Fig. 5.—" Alpha " Automatic Kettle.

pany an immersion heater is placed vertically in a circulating tube down the centre of the cylinder. The top of the tube is normally closed, but a small lift valve is operated by the expansion of the water when its temperature reaches 120 deg. F., the water escaping between the top of the tube and the seat of the valve and mixing with the general volume of the water in the container. At 160 deg. F., however, the pressure of the water is such that the hot liquid is expelled right through the centre of the valve, when it is collected within a horse-shoe

belt arrangement at the surface of the water, from which it flows down a delivery pipe. It is seen that the "Instanter" practically combines the advantages of the geyser and storage water heater. A small quantity of hot water can be almost immediately available, while only a very few minutes' wait will result in sufficient water for a wash. The apparatus is made in two sizes, 1½ and 11 gal., with capacities of 1 and 3 kW, respectively.

Fig. 6.—Rainsford & Lynes Candle Fitting.

In the "Canvary" water heater of Berry's Electric, Ltd., a system of control valves provides water at different temperatures. There are two models, bath and basin. In the former there is a special siphon arrangement whereby cold water is permitted to flow direct through the apparatus; the cold water can also be caused to mix with the hot water in the container, so as to give a medium-temperature delivery, or the hot water can be obtained direct from the container. In the smaller apparatus the water can be obtainable either lukewarm or hot. In either model the temperature of the storage water is automatically controlled by a robust thermostat which is designed to operate without the use of springs in any form. A screw adjustment is provided to vary the storage or cut-off temperature if required. The heating element, centrally arranged in the container, is of solid construction with fixed embedded wire on the periphery, so that heat generated is rapidly conducted away by the water. The element and thermostat may be withdrawn from the container without emptying. A circulating device works in conjunction with the element, ensuring an even temperature throughout the cylinder.

Fig. 7.—"Sunray Tricity" Iron.

The whole internal mechanism is mounted on one base which may be easily removed. The element, thermostat, and mains connector are self-connecting, and no internal wiring is required. The apparatus is finished in cellulose enamel throughout. The loading of the 3-gal. size is from 100 to 500 W.

An electric wash boiler which should be mentioned is a new one which was seen on the stand of REVO ELECTRIC CO., LTD. Immersion heaters are arranged on the "built-in" principle, tubes in which the elements are housed being contained in a well at the bottom of the boiler and welded to the case. The elements can be withdrawn at will from the tubes. A white-enamelled top ring and a mottled-enamelled drum or case render this a particularly attractive piece of apparatus.

Among other novel features which were to be found among the exhibits at the Fair were two automatic electric kettles with particularly substantial switches and cut-outs, one by CARRON COMPANY and one by the ALPHA ELECTRICAL APPARATUS CO. Fig. 4 shows the bottom of the "Carron" kettle. The cut-out device consists of a bi-metallic strip in arc form attached to the bottom of the kettle. At the required temperature this strip bends over and knocks the switch off. The "Alpha" kettle, fig. 5, is equipped with a power thermostat consisting of a metal drum with a diaphragm working on a vacuum. By means of a quick m. and b. action this operates a switch without the necessity of springs. The kettle is suitable for both a.c. and d.c. supplies. The action is positive, and the switch is of the ordinary single-break type. The element consists of a helix of nickel-chromium wire covered with ⅜-in. beads. The loading is 2 kW.

Again, with electric irons, enamel, and other new finishes were the chief features of the exhibits. A range of irons in all manner of colours was shown, among others, by the GENERAL ELECTRIC CO., LTD., CREDA CONDUITS, LTD., and CARRON COMPANY, while on the stand of REVO ELECTRIC CO., LTD., were seen some good examples of chromium plating. The "Sovereign" iron made by this company is wholly chromium plated and is supplied complete with a bakelite adaptor, three yards of flexible lead, and the new "Revo" connector which was described in the ELECTRICAL REVIEW of January 24th, 1930, p. 156. The loading is 450 W. The "Sunray Tricity" electric iron, fig. 7, which was observed on the stand of the BRITISH ELECTRIC TRANSFORMER CO., LTD., is manufactured entirely of steel, so that it heats up very quickly and retains its heat for a particularly long time. The element is constructed on pure mica, and the winding is of one piece and so arranged at the point, it is claimed, that the correct heat at the nose of the iron is always obtained. The connector is of good-quality bakelite, and is fitted with a finger grip for pulling it off when necessary. The iron is fitted with an earthing pin which may be used in conjunction with a 3-core flexible and an earthing plug.

A new iron shown by the "Alpha" Company, fig. 8, also has provision for the supply of greater heat at the toe. This is effected by increasing the length of the element at the point by means of a spiral formation. The element is laid in a groove in the base of the iron.

A cooker control unit in white enamel on the stand of MESSRS. J. H. TUCKER & CO., LTD., looked particularly pleasing against models in the usual green finish. In a bull's-eye type of unit a bull's-eye lens is arranged in the cover, and an ordinary m.f. lamp is carried sideways in the case. This type is equipped with a 30-A

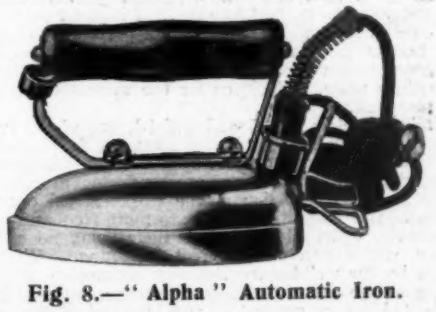


Fig. 8.—"Alpha" Automatic Iron.

switch and a 5-A 3-pin plug. The ordinary model has a 30-A switch and a 15-A 3-pin plug.

Generally speaking, electric lighting was not well represented, although there were a few outstanding exceptions, including Berry's Electric (1928), Ltd., the General Electric Co., Ltd., the Edison Swan Electric Co., Ltd., Rainsford & Lynes, Ltd., P. Webber, Ltd., and others. A notable item shown by RAINSFORD & LYNES was a handsome ceiling fitting, suitable for a large room and equipped with a 20-in. diameter English cut-glass bowl. Other R. & L. appliances were a candle fitting in bronze finish, fig. 6, and a number of pendants for one, three or five lights.

An Extra-High-Voltage Laboratory.

Brief descriptive details of the latest million-volt equipment and high-frequency plant installed at the Trafford Park, Manchester, works of the Metropolitan-Vickers Electrical Co., Ltd., for investigation and research work.

On behalf of the company, Sir Philip A. M. Nash welcomed a distinguished gathering of scientists, physicists, University professors, and engineers, who assembled at the Trafford Park works, Manchester, of the Metropolitan-Vickers Electrical Co., Ltd., on February 28th to witness the official opening by Prof. Sir Ernest Rutherford, President of the Royal Society, of the latest extension of the company's extra-high-voltage laboratory, which now consists of two semi-independent main buildings and an annex. The equipment, the whole of which was made in the company's works at Trafford Park, is designed for the study of (i) phenomena at voltages up to 1,000 kV and frequencies of from 25 to 60 cycles; (ii) transient phenomena, impact testing at voltages up to 1,500 kV, and high-frequency testing at 100,000 cycles and voltages of the order of 500 kV. The annex houses the materials laboratory, physical laboratories, a machine room wherein the generators, &c., are isolated so as to reduce noise, and offices for the accommodation of the laboratory staff.

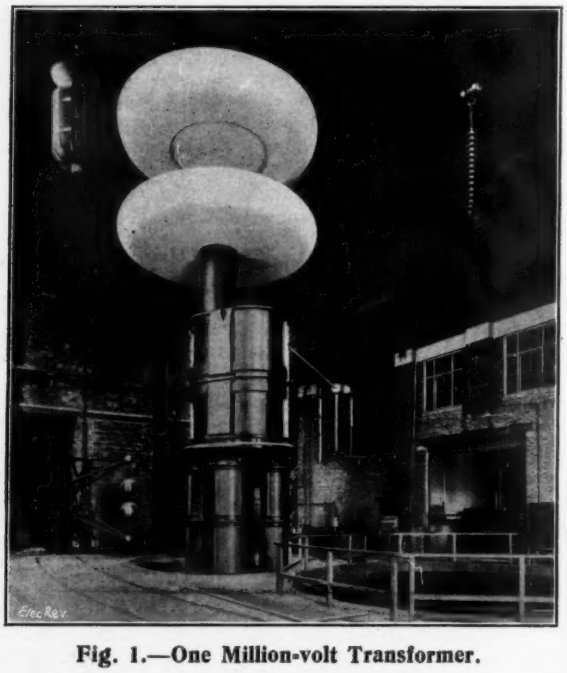


Fig. 1.—One Million-volt Transformer.

As is indicated in figs. 1 and 2 (left), one of the two main 500,000-V, 500-kVA, 50-cycle transformers is located in the main laboratory and the other in the surge laboratory. For producing 1,000,000 volts they are connected in cascade, but, as only a small proportion of the work carried out requires voltages of this magnitude, they are more frequently used independently, when the fact of their being housed in two separate rooms becomes a great advantage. When linked together by the well-known Dessauer connection, the primary winding of the first transformer has one terminal grounded and is fed by a generator; one terminal of the secondary winding is also grounded, the other terminal consequently having a voltage of 500 kV to ground. Situated at the high-pressure end of the secondary is a tertiary winding having a one to one ratio with the primary, but insulated from it for 500,000 volts. The secondary and tertiary connections are brought out through a common bushing insulator, one end of the tertiary being connected to the secondary. The second transformer of the group is a precise duplicate of the first, except that its tank is insulated from ground by pedestal insulators capable of withstanding 500 kV between their ends; its tank is connected to the secondary terminal of the first unit and is accordingly at 500 kV to ground. The primary of the second unit is fed from the tertiary of the first in such a manner that the secondary voltages of the two units are additive.

The transformers differ in several respects from previous designs. The power rating of each is 500 kVA, which is considerably greater than is usual, and that comparatively high output, coupled with the low short-circuit impedance attained (4 per cent.), enables very heavy currents to be supplied at the instant of sparkover. Structurally the transformers are of the core type, with both limbs wound. The primary winding is a single-layer spiral adjacent to the core. The secondary consists of a number of single-layer cylindrical coils arranged concentrically on the core, the length of which is smaller the greater their diameter. One end of the secondary coil adjacent to the primary winding is connected to the tank; the other end is connected to the end of the corresponding coil on the other limb, the free end of which is in turn connected back to the second coil on the first limb, and so on. In this way the diameter of the coil increases and its length decreases as the high-voltage end of the winding is approached; the general construction is thus similar in principle to that of the well-known condenser bushing, and it has the same advantages. The transformers are oil-immersed in steel tanks, reinforced to allow of vacuum drying on site. The high-voltage connections are taken through the tanks by means of 500-kV condenser-type bushing insulators, which are believed to be the highest voltage bushings yet constructed in this country.

The power supply is obtained from two motor-generator sets housed in the machine room in the annex, thereby making the transformers entirely independent of each other, although only one is required when working in the cascade connection. The generators were specially designed to maintain a pure sinusoidal voltage wave under the most adverse conditions of loading. The rotors are of the non-salient pole type and are equipped with a heavy damping winding to minimise the flux pulsation liable to occur in single-phase machines. Tooth ripples are eliminated by the use of screwed rotor slots and a fractional number of slots per pole per phase in the stator.

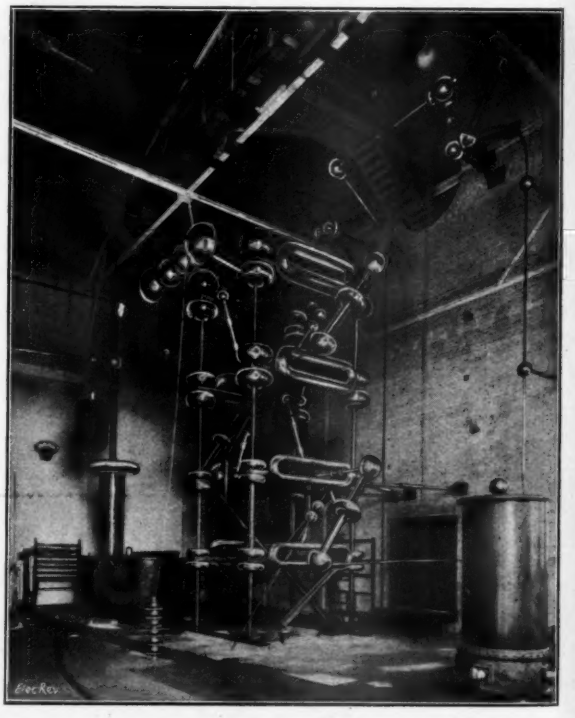


Fig. 2.—Surge Laboratory, 1,500 kV.

The field windings of the alternators are connected directly to their exciter armatures; continuous variation of the terminal voltage is obtained by means of potentiometer regulation of the exciter fields, particular care being taken to eliminate the instability of voltage liable to occur at low excitations. The d.c. motors driving the alternators are capable of continuous speed variation over a range permitting any frequency between 25 and 60 cycles to be obtained.

All controls are located at special control desks directly under the operator's hand; push buttons control the starting and stopping of the driving motors; rheostats govern their speed, and frequency meters observe it. Connection between the generator and transformer windings is established by means of push-button controlled contactors, automatically operated in a special sequence designed to avoid voltage surges on switching in and out. The potentiometer regulators controlling the voltage are motor driven and are specially designed to give a uniform rate of voltage variation over the entire range, with the motor running at constant speed, which enables the rate of voltage rise in a test to be made entirely independent of the personal equation of the operator. Also located at the control desk are the switches and dimmers governing the lighting of the laboratory and the controls of the motor-operated window blinds. It was decided not to place any reliance on the sphere spark gap, but to employ an absolute method of voltage measurement. The method

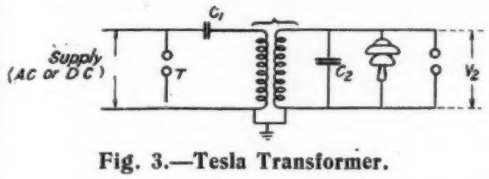


Fig. 3.—Tesla Transformer.

adopted depends upon the proposition that the *average* value of the current through a condenser to which an alternating voltage is applied is directly proportional to the condenser capacity, and to the frequency and *maximum value* of the voltage. Hence, if the capacity and frequency are known and the average current due to a given voltage is measured, the value of the unknown voltage may be deduced. A given condenser at a given frequency is so arranged that the voltage is obtained directly from the reading of a meter. The condenser has, of course, to be capable of withstanding the full value of the voltage which it is required to measure (in the present instance 1,000,000 volts); the parallel plate type of construction with air dielectric was adopted. The plates have circular symmetry, are 20 ft. in diameter, and lie in the horizontal plane; one is supported directly on the bushing insulator of the high-voltage transformer; the other, immediately

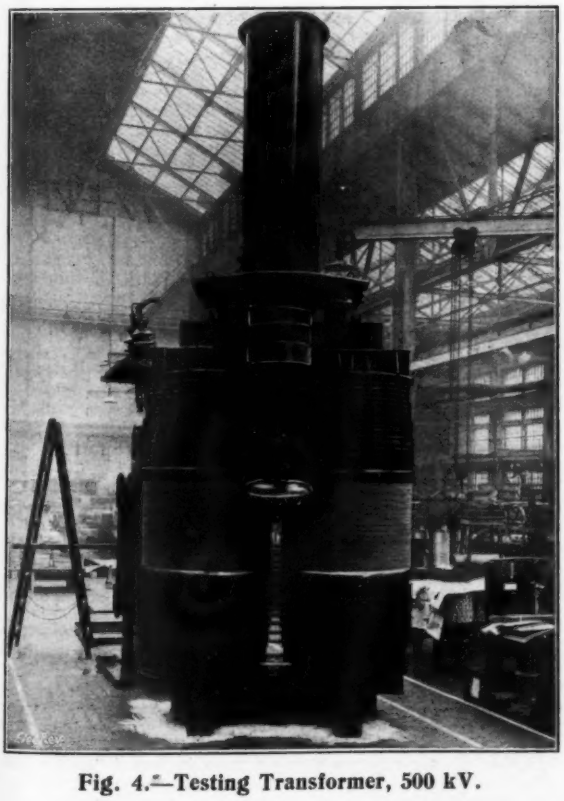


Fig. 4.—Testing Transformer, 500 kV.

above it, is suspended from the roof. This condenser is believed to be the largest ever constructed; its general appearance, together with that of the second cascade transformer and its insulating pedestals, will be apparent from fig. 1, which is an interior view of the main laboratory. The necessity of catering for full-scale experiments on oil-immersed apparatus was recognised in 1923 when a tank 15 ft. in diameter and 8 ft. deep was installed; in the new laboratory a second tank is available, 25 ft. in diameter and 10 ft. in depth, from which valuable data have already emerged; facilities for cleaning the oil are also provided.

Each of the major laboratories has a full-size railway track laid into its test area by means of which heavy apparatus can be brought in when required. Hand cranes are plentiful, while the main laboratory is also equipped with a 5-ton electric hoist, and lifting points are provided at numerous points in the roof, access to which is obtained by "cat-walks." The test areas are drained to enable spark-over tests under artificial rain to be made anywhere on the floor. Oscillating sprays have been devised which precipitate the water evenly over a large area; special nozzles allow the volume of water and size of drops to be controlled. In a special mixing tank the

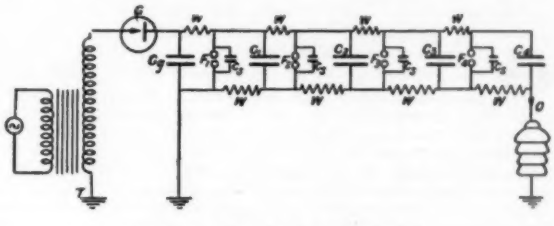
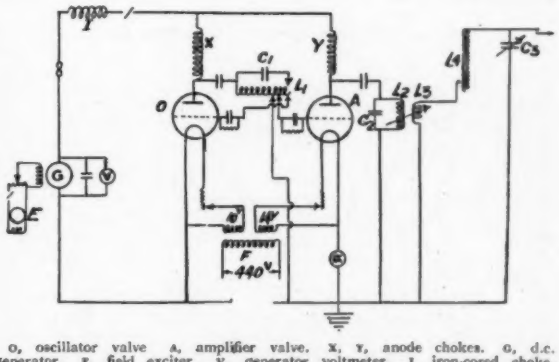


Fig. 5.—Impulse Generator.

resistivity of the water used can be adjusted to the required value. The water is forced from the tank to the sprays by compressed air, an indicating conductivity meter being inserted in the pipe line. A supply of distilled water is available for use when required. Some years ago a fume chamber was installed in the original laboratory in which surface deposits on insulators could be built up. After the formation of the deposit the most instructive procedure is to observe the discharge and sparkover voltage of the insulator as a function of the humidity of the air.

Dielectric phenomena at transient voltages are receiving ever increasing attention. Operating experience seems to indicate that in systems insulated in accordance with modern practice (earthed neutral) lighting is the only source of overvoltage requiring serious consideration, largely because the magnitude of the surges of internal origin bear some proportional relation to the working voltage of the system, and are therefore looked after by the safety factor which experience has shown to be desirable. The voltage impulses set up in a transmission line by lightning travel along the circuit and undergo reflection at various points, so that, although the initial lightning disturbance may be non-oscillatory, it is unsafe to conclude that its effects will be so as well. The company's tests are therefore made with both impulsive and oscillatory voltages, and with varying wave fronts and frequencies.

The impulse generator (fig. 2) consists of a multiplying circuit (fig. 5) d.c. charged, with 250 kV per stage, giving



O, oscillator valve A, amplifier valve. X, Y, anode chokes. G, d.c. generator. E, field exciter. V, generator voltmeter. I, iron-cored choke. A, plate ammeter. L_1, grid coil. C, grid capacity. L_2, L_3, coupling coils. L_4, secondary tuning inductance. C_3, secondary tuning capacity. F, filament transformer.

Fig. 6.—Damped Oscillation Generator.

four stages for 1,000,000 volts. Thus T is an ordinary power-frequency transformer, the voltage of which is rectified by the mechanical rectifier G and smoothing condenser C_9. From the continuous supply so obtained, the four main condensers C_1-$_4$ and stabilising condensers C_{s_1} are charged in parallel over the isolating resistances W. The trigger gaps F_1-$_4$ are set so that their sparkover voltages V_1-$_4$ increase slightly in the order V_1 V_2 V_3 V_4. When the voltage across the first gap F_1 rises to a sufficient value, breakdown of the gap will occur and will be immediately followed by the breakdown of the whole series of gaps, the main condensers being thereby connected suddenly in series. When this occurs, between the point O and ground, there will appear an impulsive voltage, the magnitude of which will be very nearly equal to the sum of the individual condenser voltages at the instant of

breakdown, roughly 4 v_1, the rate of rise of which will be governed by the inductance of the connections and the rate of decline of voltage across the trigger gaps. The function of the stabilising condensers is to make this rate of decline rapid and to maintain the conditions in the trigger gaps substantially independent of the impedance in the output circuit.

The way in which the above scheme was realised in practice will be apparent from fig. 2. The main structure is a four-post vertical frame divided into four storeys corresponding to the four stages of the circuit. The main condensers are cylindrical and are mounted horizontally at the upper end of each frame section. The trigger gaps and isolating resistances connecting the adjacent sections are mounted diagonally on the main frame. At the instant of discharge the voltage rises uniformly up the frame, the junction of the respective sections being at 250, 500, 750, and 1,000 kV to ground. A number of stress distributors are provided in order to suppress all discharges; up to 1,500,000 volts to ground has been produced by means of this apparatus.

Damped oscillations of high voltages are produced by means of a Tesla transformer, fig. 3. The primary condenser C_1 is charged from an external source up to a voltage V_1 corresponding to an energy storage of $W_1 = \frac{1}{2}C_1V^2_1$, V_1 being the breakdown voltage of the trigger gap T. When this gap arcs over, the condenser C_1 discharges through the primary circuit. The primary current gives rise to an oscillatory voltage across the secondary condenser C_2, which at some instant will attain its maximum value V_2, corresponding to an energy storage of $W_2 = \frac{1}{2}C_2V^2_2$ in the secondary condenser.

The process therefore transfers energy between the primary and secondary circuits and, since the entire energy involved is originally stored in the primary condenser, the secondary energy W_2 can in no case exceed W_1 and can only equal it if the efficiency of the energy transfer process is unity. Writing m^2 for that efficiency we have $W_2 = m^2W_1$ or $V_2/V_1 = m\sqrt{(C_1/C_2)}$, which equation gives the voltage ratio of the coil as a function of the ratio of primary and secondary capacities and the transfer constant m. The value of m can never exceed unity and is determined firstly by the tuning and coupling of the two circuits, and secondly by the energy losses in the conductors, spark-gaps, and insulation. It attains its maximum value when the primary and secondary circuits are approximately isochronous. The above equation indicates, first, that the voltage ratio of the transformer for a given value of m depends only upon the ratio of the capacities and, secondly, that the greater the capacity of the apparatus under test (C_2) the greater must be the primary capacity for a desired transformation ratio. The frequency of the oscillations is of the same order of magnitude as the natural frequency of the primary circuit, *i.e.*, $f = 1/2\pi\sqrt{(C_1L_1)}$, where L_1 = primary inductance and C_1 = primary capacity.

The Tesla transformer installed at Trafford Park is rated at 750,000 volts, 100,000 cycles, with coupling coefficients of either 35 or 8 per cent. At this voltage it is capable of dealing with loads of a capacity up to about 600 m.m.f., equivalent to a large oil switch with several bushing insulators.

The measurement of impulsive and oscillatory voltages is difficult, since, in addition to the maximum value, the whole form of the wave is of importance. Magnitudes can be measured with fair accuracy by a sphere gap, but the wave forms of voltages of such short duration can be determined only by means of a cathode-ray. The first oscillograms of this nature were obtained by Professors Rogowski and Norinder quite recently. An oscillograph similar in type to those employed by these scientists has been constructed in the "Metrovick" Research Department, and is now installed in the surge laboratory; the photographic technique has been greatly improved. For producing undamped oscillations with smooth and continuous voltage variation over a wide range the valve circuit shown in fig. 6 was devised. The insulator to be tested is connected across the condenser C_2 in the secondary circuit, which is coupled to the primary anode circuit of the main valve through a variometer. The grid of this valve is excited, not from its own anode circuit, but by means of a small master oscillator, the main valve thus acting merely as an amplifier. Voltage variation can be effected either by changing the coupling between the primary and secondary circuits, or by varying the continuous anode voltage of the valves. A circuit of this type giving a maximum voltage of 150,000 volts at 100,000 cycles is installed in the laboratory as a permanent piece of equipment.

Means of producing a high continuous voltage is essential to the operation of the impulse generator previously described; continuous voltages are also used for the pressure testing of cables and apparatus, so that the study of dielectric phenomena with this type of voltage has practical significance as well as scientific interest. Two rectifier sets are installed in the laboratory. One, of the mechanical type, is used mainly in connection with the impulse generator; the midpoint of the condenser bank is grounded, the maximum voltage which can be produced between the outer terminals being about 700,000 volts. A second set equipped with thermionic rectifiers is used for tests with continuous voltage; the maximum voltage is 250 kV.

The materials-testing laboratory is housed on the ground and first floors of the annex. The investigations carried out in it extend over a very wide field. Breakdown and loss tests on insulating materials, electro-mechanical tests on porcelain insulators, design studies on switchgear, transformer, and generator parts are of frequent occurrence.

London Electricity Supply.

Extracts from the J.E.A. Report for 1928-29.

THE present issue of the "Electricity Supply Return*" for the year 1928-29 (*i.e.*, local authority undertakings for the year ended March 31st, 1929, and Company authorised undertakings for the year ended December 31st, 1928) for the London and Home Counties Electricity District is the third to be published by the Joint Authority. This issue follows generally the arrangement of information and statistics adopted in the earlier returns, and agrees as far as possible with the figures published by the Electricity Commissioners.

The area of the Electricity District is approximately 1,797 square miles, stretching from Hertford and St. Albans in the North to Dorking and Reigate in the South, and from Windsor in the West to Gravesend in the East. According to the 1921 census the population was 8,178,766, and the assessable value at 6th April, 1927, was approximately £83,340,000. The kWh generated and sold by authorised undertakers in the district represent approximately one-fifth of the total generation and sales by authorised undertakers in Great Britain.

There were 93 undertakings owning 62 operating generating stations with an installed capacity of 1,456,444 kW (as against 1,254,507 kW in 1927-28). These authorities are classified as follows, the proportion of generating plant which they own being shown in parenthesis:—Metropolitan Borough Councils 16 (24.3); extra-London local authorities 28 (12.9); London companies 16 (54.3); extra-London companies 33 (8.5). One undertaking had a load factor (on kWh generated or purchased) exceeding 40 per cent., 13 between 30 and 40 per cent., 67 between 20 and 30 per cent., and 11 under 20 per cent. The aggregate maximum load amounted to 1,261,422 kW, including 390,133 kW bulk (local authorities 40 per cent., companies 60 per cent.).

The total number of kWh sold (excluding intersales) was 1,758,752,078 (compared with 1,493,880,881 in 1927-28), and represented an increase of 17.7 per cent. These sales were apportioned as follows:—Metropolitan Borough Councils, 22.4 per cent.; extra-London local authorities, 15.4 per cent.; London companies, 46.4 per cent.; and extra-London companies, 15.8 per cent.

Of the total sales (excluding bulk supplies) 41.2 per cent.; was sold for lighting and domestic purposes (22.6 per cent. increase); 2.5 for public lighting (9.6 per cent. increase); 13.9 per cent. for traction (29.1 per cent. increase); and 42.4 per cent. for power (10.7 per cent. increase). At the close of the period £79,027,053 (compared with £70,592,497) had been charged to capital account. This was divided as follows:—Generating, 37.2 per cent.; main transmission lines, 9.0 per cent.; distribution, 46.3 per cent.; hired apparatus and miscellaneous, 7.5 per cent. The working costs (including bulk purchases, but excluding capital charges) aggregated £8,247,025 or 0.71d. per kWh sold. The costs per kWh sold by the various groups were: Metropolitan Borough Councils, 0.71d.; extra-London local authorities, 0.85d.; London companies, 0.63d.; and extra-London companies, 0.88d. The average prices received were reduced under every category: Lighting and domestic from 3.52d. to 3.05d.; public lighting from 1.47d. to 1.36d.; traction from 0.74d. to 0.6d.; power from 1.25d. to 1.09d.; and bulk from 0.78d. to 0.67d. These reductions, excluding bulk supplies, represented a total saving to consumers of £2,098,200.

Forty-six undertakers charged 6d. and over per kWh for lighting, and 12 under 4d. For heating and cooking, 5 undertakings charged 4d. and over, and 9 under 1d. For power, 12 undertakings charged 4d. and over, and 5 under 1d. During the year ended 31st December, 1929, the number of authorised undertakers who notified reductions in charges was:—Lighting, 29; power, 13; heating and/or cooking, 19.

Allocated to the various classes of undertaking, the average prices charged per kWh for lighting and domestic uses were as follows:—Metropolitan borough councils, 2.32d.; extra-London local authorities, 2.53d.; London companies, 3.59d.; extra-London companies, 3.95d. For power the corresponding prices were 1.10, 1.04, 1.22, and 0.92d. The total gross surplus amounted to £8,005,061, municipalities £2,635,620, and companies £5,369,441. The municipalities made the following appropriations: Interest on loans and deposits, £778,312; sinking funds and loan repayments, £1,052,870; special expenditure, £309,418; depreciation and renewals, £349,607; contributions to rates, £82,876. The balances on net revenue account were increased by £62,537. The figures for companies exclude certain small undertakings; the amount shown for interest is £1,068,475; reserve and renewals, £1,891,482; preference dividends, £537,414; and ordinary dividends, £1,439,233. The balances were increased by £301,990.

Rates paid (£851,939) were 74.2 per cent. over 1925-26, and 110.5 per cent. over 1920-21. The report gives full particulars relating to each authorised undertaker in the area. A statement of charges made by each undertaker as at January 1st, 1930, is also included; this was issued as a separate publication.

* Published by the Authority, 5, Millbank, S.W.1. Price 5s.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

New Transmission Construction Company.

Mr. J. L. Eve, who for the last four years has been in charge of the Foundation Company's overhead transmission line department, has formed a company whose work will be mainly the erection of overhead transmission lines. The new company —the J. L. Eve Construction Co., Ltd., 272-4, Vauxhall Bridge Road, S.W.1, has taken over the technical staff of the Foundation Co.'s transmission line department and has secured the undermentioned contracts by negotiation with the receiver of the Foundation Co., Ltd. :—Shropshire, Worcestershire and Staffordshire Electric Power Co., Ltd., Ludlow-Craven Arms; the County of London Electric Supply Co., Ltd., Barking-Romford overhead line; and the Central Electricity Board, River Tay Crossing. The approval of the authorities concerned has been obtained to the transfer of these contracts.

Recent Contracts.

The United Steel Companies, Ltd., have placed with the Metropolitan-Vickers Electrical Co., Ltd., an order for an electric induction furnace for steel melting to be installed at the works of Messrs. Samuel Fox & Co., Ltd., Stockbridge. The furnace will be of ¼-ton capacity, and of the Metropolitan-Vickers standard design. During the past year or so furnaces of this type have been installed at a number of works in Sheffield and elsewhere, including the works of Vickers-Armstrongs, Ltd., and Hadfields, Ltd., and have been in continuous commercial operation, producing steels formerly made by the pit-fire crucible process. The company says that the equipments have given complete satisfaction, and the placing of the present order indicates that the furnaces have passed creditably through their probationary period. It is claimed that the coreless induction furnace gives more accurate control over the composition of the product and therefore over the quality of steel produced. Actual records over six months' operation in a large steel works show that steel of crucible quality has been melted at an overall cost, including labour, power, overhead and depreciation charges, of about £9 per ton, as compared with £16 per ton for the crucible process. The ¼-ton furnace melts its charge in about one hour, and the records above-mentioned show that for an output of about 50 tons per month the average overall power consumption has been about 770 kWh per ton.

A further addition has recently been made to the fleet of electric mine locomotives used by the Coltness Iron Co. These locomotives are all manufactured by the British Jeffrey-Diamond, Ltd., Wakefield. They are capable of hauling on the level about 60 tons of pit tubs with plain bearings and about twice this weight of tubs equipped with roller bearings, at a speed of about 6 miles per hour. They are equipped with two 17-h.p. totally-enclosed, series wound, 80-V motors, each driving one axle of the locomotive through single-reduction machine-cut spur-gearing enclosed in an oil-tight gearcase. The locomotives are also each equipped with a series-parallel controller, steel-tired wheels, self-locking brakes, sanding devices on all four wheels, powerful headlights, and an ampere hour meter to show the state of charge of the battery. The driving power is supplied by "Kathanode" (D.P. Battery Co., Ltd.) batteries which are able to withstand heavy discharge rates. Two batteries are supplied with each locomotive so that whilst one is in use the other can be charged. The batteries are mounted in removable boxes so that a discharged battery can be pushed off on to the charging platform and replaced by a fully-charged battery, this process occupying only three or four minutes.

Messrs. Bruce Peebles & Co., Ltd., Edinburgh, have secured an order for a mercury-arc rectifier equipment from Edinburgh Corporation. The order comprises a 1,500-kW "Peebles-Brown Boveri" rectifier, designed for 3 phase, 50-cycles, 6,500/6,800 V on the a.c. side, and 550/600 V on the d.c. side. The rectifier will operate on a traction load.

The A.E.G. in Ireland.

The announcement is made of the formation of a company in Dublin by the Allgemeine Elektricitäts Gesellschaft. This new concern—the Irish A.E.G. Electric Co., Ltd.—will act as the distributing company for the German company's products in the Irish Free State. The Siemens Schuckertwerke has an Irish subsidiary—Siemens Schuckert (Ireland), Ltd.

E.D.A. Conference.

An interesting lecture was given in Messrs. Sopwith's Lounge, Northumberland Street, Newcastle-upon-Tyne, on Wednesday, February 26th, at 7.15 p.m., by Mr. S. Burns, M.I.E.E., who chose for his subject "Modern Days—Modern Ways." Mr. Burns dealt with the tremendous advance that has been made in the past 100 years and by means of lantern slides depicted how electricity had brought about wonderful changes in the working conditions, output, &c., in mines, shipyards, railways and mills.

The next conference of the E.D.A. (North-East Area) will take place in Messrs. Sopwith's Lounge on March 26th, at 7.15 p.m., when Mr. K. M. McKenzie, of Messrs. Reyrolle and Co., will give a paper on "Generation and Supply of Electricity." This conference is specially arranged for the benefit of the younger members of the electrical industry.

Metropolitan-Vickers Long Service Association.

Over 800 of the 1,020 employés who have served the Metropolitan-Vickers Electrical Co., Ltd., for twenty years or more sat down to supper on February 24th in one of the works' canteens at Trafford Park, and afterwards enjoyed an entertainment provided for the most part by the M.V. male voice choir and M.V. orchestra. Sir Felix Pole, chairman of Associated Electrical Industries, Ltd., was the guest of the evening, and Sir Philip Nash, chairman of the Metropolitan-Vickers Electrical Co., Ltd., occupied the chair as president of the Association. Mr. Philip Lang, who was managing director of the company in its early years, was also present. Sir Felix Pole in his speech thanked the Association for inviting him, though a newcomer, to attend their annual meeting, and congratulated them all on their good fortune in having served a firm of such standing for so long.

Wages in the Engineering Industry.

Another meeting took place in London last week between representatives of the Engineering and Allied Employers' Federation and the engineering trade unions. The union representatives proposed that their claim of an increase of 8s. per week in the wages of time workers, which the employers had rejected, should be submitted to arbitration. Sir Allan Smith, replying on behalf of the employers, would not entertain the proposal, pointing out that conditions in the engineering industry were still very unsatisfactory. He suggested, however, that the unions should co-operate with the Employers' Federation in an investigation of working costs and conditions in foreign countries. Mr. J. T. Brownlie, speaking for the trade union representatives, said that they had no power to agree to this course, but they would place the proposal before a conference of the unions' executives at an early date.

An American Import Exhibition.

So great is the interest of the United States in the European markets as a source of supply (for America buys something like £1,000,000,000 worth of goods from Europe in the course of the year) that a great Industrial Exposition of American Import Trade is to be held at the Grand Central Palace, New York, this year from August 4th to 9th. America buys a considerable quantity of British merchandise, and this exhibition, therefore, affords a good opportunity for British manufacturers to extend and consolidate their connections in this wealthy market. The representatives for Great Britain and Northern Ireland and the Dominions are the International Trade Exhibitions, Ltd., Broad Street House, E.C.2.

Liverpool and Registered Contractors.

The Liverpool Co-ordination Special Committee has had under consideration a resolution passed by the Tramways and Electric Power and Lighting Committee to the effect that it was in the interests of consumers to have their wiring installations carried out by contractors who are in possession of the certificate of the National Register of Electrical Installation Contractors. The city electrical engineer has suggested that tenders for corporation work be invited only from contractors who are in possession of the certificate.

Central European Electrical Trade.

The February *Review* of the Anglo-International Bank, Ltd., states that electrical machinery valued at 349 million Czech crowns (£2,123,000) was imported into Czecho-Slovakia during 1929. The total for 1928 was 264 millions (£1,600,000).

It is also shown that Hungary's imports of electrical machinery had a value of 26,395,000 pengoes (£946,000) in 1929, against 21,306,000 pengoes (£766,000) in 1928. Exports of electrical machinery from Hungary rose from 18,657,000 pengoes (£670,000) in 1928 to 23,300,000 pengoes (£838,000) in 1929.

Social Events.

A social and dance of the workpeople and staff of the Edison Swan Electric Co., Ltd., was held on February 21st at the Baronial Hall, Alexandra Palace. Dancing commenced at 7 p.m. and a whist drive was held at the same time in the balcony. During the evening the dances were interspersed with items given by concert artists. The large number of prizes for the whist drive, lucky numbers, and "spot" dances provided by the directors, management and staff, were presented by Mrs. F. V. Hasemore. Over 1,500 employés and friends attended and among those present were Messrs. P. Kilby and F. V. Hasemore (directors), Dr. C. E. Hiatt and Mr. F. J. Evans (works managers), Messrs. T. S. Read, J. W. Elliott and J. R. Thomas (joint sales managers), and Mr. J. H. W. Morgan (the company's accountant).

A successful dance, organised by the staff of the Sun Electrical Co., Ltd., was held at the Victory Hall, Leicester Square, on February 22nd, under the capable management of Mr. A. G. Owen. As with all "Sunco" social functions, the evening went with a swing, and close on 200 of the staff and their friends spent a really enjoyable evening. Among those present were Mr. A. G. Beaver (managing director), and Mrs. Beaver, Mr. D. M. Fraser (Leeds manager), and several heads of departments.

The second staff dance of the season of Messrs. Johnson and Phillips, Ltd., was held at Woolwich Town Hall on February 28th, and was attended by a more than usually large number of the staff and their friends. Mr. J. Macgregor, chairman and managing director, and Mr. C. Stewart, director, were present, and prizes were presented for various competition items by Mrs. Macgregor and Mrs. Stewart.

Unemployment.

There was a further increase of 3,926 in the number of unemployed persons during the week ended February 17th, at which date the total was 1,523,900, as compared with 1,519,974 on February 10th, and 1,458,032 on February 18th, 1929.

Commercial Electrical Travellers.

The fifth annual dinner of the Electrical Trades Commercial Travellers' Association was held at the Connaught Rooms, Great Queen Street, W.C., on February 28th, Mr. R. W. Whitley, chairman, presiding. In proposing the toast of "The President," Mr. Whitley said that Mr. Hornby's knowledge of salesmen and his judgment of salesmen were unique. He remembered Mr. Hornby once saying that the sales engineer was the most important link in the chain of success of a company. Referring to the origin of the Association, Mr. Whitley said that it was formed six years ago in the reign of Mr. Marks, and since its formation it had shown continued progress, both numerically and as regarded its help towards various charities. It was realised, however, that something had to be done to retain existing members and induce other travellers to join the Association. A scheme had therefore been drawn up with the object of finding the right job for the right man. A questionnaire had been sent out to all members, asking them to state in confidence their abilities and experience. The replies so far received totalled almost 70 per cent. Mr. R. Hornby, in responding to the toast, said that he would define the Association as one of selling men, sales engineers, or travellers, which was quite an honourable term. The travellers had determined during the past week the amount of employment during the coming week. He expressed the opinion that the future of the electrical industry was in the hands of the travellers, and the competent traveller should receive what he earned. The status of the electrical traveller was the status of the industry. Returning to the objects of the Association, he hoped that as it was started in charity so it would continue in charity. Every member should have on a card index a record of his ability ready for reference when a better job should arise, and he urged those who had not filled in the questionnaire to do so. Mr. F. C. Chown proposed "Our Guests," which was responded to by Mr. Lee. Mr. J. W. Ward proposed "The Chairman," and Mr. Whitley responded. A collection made during the evening on behalf of the Association's charities realised £12 15s. 6d.

Advertisement Correction.

By an unfortunate misprint in the advertisement of Measurement, Ltd., on p. xvi of our last issue, the word "motor" appeared instead of "meter" in the fifth line.

The Australian Railways.

In a recent leading article of the *Industrial Australian and Mining Standard* the sale of the Government-owned railways of Australia to private interests was advocated and the proposal has secured the support of a number of the journal's readers. It was maintained that the Government, influenced as it was by political considerations, could never make a success of railway operation, and it was advisable to sell the system to reduce the Commonwealth debt and put an end to further loss.

Swedish Works in Russia.

It is stated that the works of the Allmänna Svenska Elektriska A.B. at Yaroslaff, which were begun in 1916 and formed the subject of a concession granted to the Swedish company in 1927, were completed last year, and the erection of the plant for working on a large scale was finished early this year. Various departments have already been brought into use and operations at full capacity are expected to take place in a year. The production will comprise the construction of three-phase motors up to 750 h.p., and the annual normal capacity at full load is calculated at 30,000 machines of an average size of 5 to 6 h.p. About 1,000 workers will be employed. At present some 50 Swedes are on the spot as specialists and instructors.

Industrial Welfare.

Speaking at the Industrial Welfare Society's banquet on February 26th, the Duke of York (president) said that in making its appeal, the Society had always borne two things in mind. One—that there was no hope of industrial advancement unless it was founded upon a true estimation of human values; the other, that the individual workshop must be the theatre of operation. Their main purpose was to remind both masters and men that relationships in industry were, first of all, human and social.

Belgian Electricity Supply Organisation.

The Brussels correspondent of the *Daily Telegraph* reports that an agreement has been reached between all the Belgian electrical undertakings with a view to organising on a sound basis the production and distribution of electricity throughout the country. The Electrobel Company, one of the most important Belgian concerns, is to be reorganised for this purpose, and its activities will be placed under the control of the Société Générale, the Banque de Bruxelles, the Banque de Paris et des Pays Bas, the Mutuelle Solvay, and the Sofina Co. One of the most significant consequences of the agreement is the fact that for the first time it establishes relations between two companies which count among the most important on the Continent—the Société Générale, as a banking organisation, and the "Sofina," as a great electricity concern.

Departmental Estimates.

The estimates of expenditure of Government Departments issued a few days ago show that the Department of Overseas Trade requires £124,339 more than last year. This is due, in part, to the increased cost of the British Industries Fair (£4,425) and higher salaries in the commercial diplomatic service (£20,533). The Ministry of Transport's estimate includes a further £14,650 in respect of the cost of investigating the possibilities of the Severn as a source of power.

Radio Manufacturers' Stop List.

In an endeavour to eliminate the price cutting which is so rife in the radio apparatus trade the Radio Manufacturers' Association has decided to institute a "stop list," giving the names of firms and individuals who sell apparatus below the manufacturers' stipulated prices.

Electric Irons in Australia: High Cost of Production.

Some remarkable figures were put forward recently when Australian manufacturers of electric irons applied for an increase in the duties on imported irons to enable them to compete with overseas producers. The applicants asked that the duties should be 10s. 6d., 11s. 6d., and 12s. 6d. under the British, intermediate and general tariffs, respectively, and it was stated in evidence that foreign irons had been landed in Australia at an invoice value of 4s. 6d. each. A local manufacturer's representative stated that his company's actual production cost was 18s. 9d. Mr. Alexander Stewart (Hecla Electrics Pty., Ltd.) said that most of the irons complained of were of European origin and they were retailed at prices ranging from 10s. 6d. to 18s. 6d., which was from 8s. 6d. to 12s. below the Australian cost of manufacture. Asked why Australian irons should cost three times as much to produce as foreign irons, Mr. Stewart said he was inclined to think that the foreign manufacturer was subsidised.

Mr. J. J. Rafferty (Alex. N. Cooke & Co., Pty., Ltd.), said that his company produced irons at 18s. 9d. each. The wholesale price was 23s. 9d., and the price to the public 40s. He agreed that there was a tremendous disparity between the last two figures and thought that it was not justified.

Central Electricity Board Contract.

A contract has been placed with the General Electric Co., Ltd., by the Central Electricity Board for six 30,000-kVA 3-phase transformers for the Mid-East England Electricity Scheme. These transformers, the windings of which will be suitable for pressure ratios of 132,000/11,000-V and 132,000/6,600-V on a 3-phase, 50-cycle system, will be complete with G.E.C. on-load tap-changing gear and external automatically-controlled forced-air cooling equipment. They will be manufactured in Birmingham at the Witton Engineering Works of the G.E.C. and installed at Kirkstall, Bradford, and Rotherham, Yorks.

Book Notices.

The Municipal Review, Vol. 1, No. 1, January, 1930. London: Solicitors' Law Stationery Society, Ltd. (for the Association of Municipal Corporations). Price 6d. monthly (7s. 6d. per annum post free).—The numerous, and increasingly important, powers wielded by local authorities could not be adequately covered in the "Monthly Circular" issued to its members by the Association of Municipal Corporations. Consequently this monthly *Review* has been produced as the Association's official organ and it should be of great service to all interested in local government. The first issue contains introductions by Mr. Arthur Greenwood, the Minister of Health, and Lord Derby, president of the Association. There are also articles on the subjects of public health, water supply, roads and road transport, as well as legal, Parliamentary, personal and news matter. One particularly interesting article, "The Elusive Therm," by Mr. A. Valon, M.Inst.C.E., discusses gas supply and the effects of electrical development upon that industry. The author maintains that "there is no prospect of the financial stability of gas undertakings being impaired by electrical competition."

"Southampton Docks," compiled by H. N. Appleby. London: Southern Railway Co. This publication contains very full information regarding the general, foreign and Continental trade of the port of Southampton with details of the various docks and rates and charges on tonnage (exports and imports), rates of rent on goods, conditions in connection with the use of the floating dock, and bye-laws of the docks. The handbook is well produced and contains a number of excellent illustrations of the docks.

"Sell's Dictionary of Registered Telegraphic Addresses, with Telephone Numbers and Classified Trades." London: Business Directories, Ltd. Price 45s.—With the 1930 edition, this useful directory attains its 45th year. A new feature has been introduced in this issue whereby the registrant may have his name and address added after the registered telegraphic address in Section II to save a reference back to these particulars. The American and overseas sections have been enlarged.

"*Journal* of the American Institute of Electrical Engineers." Vol. XLIX. February, 1930. New York: The Institute. Price $1.

"Science Abstracts (A & B)." Vol. XXXIII. February, 1930. London E. & F. N. Spon, Ltd. Price 3s. 6d.

"Electrical Wiring and Contracting." Vol. III. Edited by H. Marryat. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net.

"Telegraphy." By T. E. Herbert. Fifth edition, revised and enlarged. Pp. XXV+1199; figs. 750. London: Sir Isaac Pitman & Sons, Ltd. Price 20s. net.

Publication of the Association of Engineering and Shipbuilding Draughtsmen.—"The Balancing of Engines," by C. C. Pounder. Price, 4s. net.

For Sale.

The liquidator of Messrs. H. A. McQueen & Co., Ltd., Glasgow, offers the business of the company for sale as a going concern. Farnworth Urban District Council has for sale two 200-kW, 3-phase, generators, two transformers, h.p. and l.p. switchgear, panels and instruments. (See our advertisement pages to-day.)

British Manufacturers in Australia.

The Melbourne *Herald* recently reported an interview with Mr. A. Oakley who had arrived in Melbourne in the interests of his company, the Telephone Manufacturing Co., Ltd., which has a subsidiary in Australia—the New System Telephones Pty., Ltd. Mr. Oakley informed our contemporary that in consequence of the increases in the Commonwealth Customs tariff, his company had decided to expend £25,000 in developing the activities of its factory in Sydney. He maintained that Australian-made apparatus of the kind in which the company specialised was equal to any made in England or on the Continent. He was convinced that other companies in England would commence manufacturing in Australia. "I prophesy," he said, "that within 10 years many of the leading companies in England will have factories in Australia to manufacture the goods they are now sending here. English manufacturers are looking to the Dominions and Colonies to-day."

Industrial Production in 1929.

The *Board of Trade Journal* of February 27th publishes a survey of industrial production during 1929. Industries are shown in ten groups and the 1924 level (taken as 100) is used as a basis of comparison, but for one group—paper and printing—no adequate information is available. Three of the groups—mines and quarries, textiles, and leather (boots and shoes)—recorded slightly lower production than in 1924, but the rest showed increases. Gas and electricity made the greatest advance, the index figure being 135.7, against 126.0 in 1928. The next best was the engineering and shipbuilding group which had a figure of 120.9, as compared with 113.1 in 1928. The improvement is attributed mainly to a substantial advance in electrical engineering and in shipbuilding and marine engineering. The B.E.A.M.A. index of production in the electrical industry, which is referred to in another part of the *Journal*, shows that in 1929 (with 1924=100 as a base) production reached a figure of 107.0, as compared with 89.8 in the preceding year.

The E.D.A. Annual Meeting.

The annual general meeting of the British Electrical Development Association is to be held at the Savoy Hotel on March 21st, at 3 p.m. It will be preceded by a luncheon at which Capt. J. M. Donaldson, M.C., will preside, the principal guest and speaker being Mr. Herbert Morrison, the Minister of Transport. Tickets for the luncheon (17s. 6d. each, inclusive of wines and cigars) can be obtained from the Association at 15, Savoy Street, W.C.2.

An Australian Electrical Exhibition.

An electrical exhibition is being organised by the Electrical Federation (Victoria) to take place in Melbourne in September next. The arrangements are said to be well in hand and it is hoped that the exhibition will be on an even larger scale than that of 1927.

Association of Ex-Siemens Men.

The annual dinner of this Association will be held at Gatti's Restaurant, King William Street, Strand, W.C.2, on March 20th. Mr. J. Snow Huddleston, M.I.E.E., Siemens Bros. & Co., Ltd., Dagenham Dock, Essex, is the hon. secretary and treasurer, and particulars of the Association and of the dinner can be obtained from him.

Business Efficiency Exhibition.

The Business Efficiency Exhibition, organised annually by the Office Appliance Trades Association, was opened at the White City on March 4th, and remains opened until March 15th. As in previous years there is a large variety of electrically-operated machines, including adding, addressing, calculating, tabulating, and sorting machines, typewriters, dictating machines, facsimile printing machines, time recorders, &c. Many of the machines are constructed with built-in motors as an integral part. Inter-communication systems are exhibited by the Dictograph Telephones, Ltd., the Relay Automatic Telephone Co., Ltd., the Reliance Telephone Co., Ltd., British Home and Office Telephone Co., Ltd., and New System Private Telephones, Ltd. A new exhibit by Mail Room Equipment, Ltd., is the "Lightning" letter opener, which is electrically-operated with automatic feed and adjustment for various sizes and thicknesses of mail. The Typerlite Co. is displaying a wide range of lamp standards, which includes a number of new designs. Among these is a factory fitting with six adjustments, allowing the light to be directed at almost any angle. A portable factory fitting on a cast-iron base is also shown, which can be raised or lowered as desired. Other new fittings are standards for bank counters, desks, &c.

Bankruptcy Proceedings.

E. H. NEWMAN AND M. BAYNES (lately trading as Langham Radio), 56-61, New Oxford Street, W.C.—These debtors attended at the London Bankruptcy Court on February 21st before Mr. Registrar Mellor for public examination. Their statement showed liabilities of £11,143 and no assets. According to the evidence, Baynes began business in New Oxford Street in 1925, dealing in wireless goods, and having a capital of £500. In 1926 he and another person started a similar business in New Oxford Street under the style of Langham Radio, but the partner left the firm in March, 1927, and the business was continued by Baynes. In 1927 a factory was taken and Baynes agreed to allow Newman (who had been acting as salesman) 50 per cent. of the profits of the business. In 1928 arrangements were made for the formation of a French company to deal with wireless goods and to take over a second factory. Accordingly the Langham Radio was registered in France with a capital of 100,000 fr. Both debtors subscribed cash, and goods were provided by the London business. The company is now in liquidation. The debtors attributed their failure to liability to the petitioning creditors, whose claim was not included in a deed of inspectorship which they executed in September, 1928. The further examination of the debtors was postponed until March 3rd. The following are creditors:—

	£		£
Marconi's Wireless Telegraph Co., Ltd. ...	11,066	M. MacDougall, Ltd.	77

R. C. HUDSON, electrical engineer, &c., 1 and 2, Bridge Road, Chatburn, Lancs.—Last day for proofs for dividend, March 11th. Trustee, Mr. J. W. Carter, Official Receiver, District Bank Chambers, Blackburn.

J. A. CANE, T. P. CANE, and D. R. CANE (Cane Bros.), consulting and electrical engineers, Sturry, Kent.—First meeting held March 6th at Carey St., W.C. Public examination March 25th at the Guildhall, Canterbury.

A. P. GODDARD, electrician, 25, Silver Street, Doncaster.—First meeting held March 6th at the Official Receiver's offices, Figtree Lane, Sheffield. Public examination March 20th at the County Court Hall, Sheffield.

W. WORSNIP, wireless dealer, 36, Market Hall, Walham Green, S.W.—Bankrupt's discharge suspended until January 28th, 1931.

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A. Slatterthwaite (Gregson & Co.), electrical engineer, 22, Dutton Street, Liverpool.—Trustee, Mr. P. S. Booth, 2, Bixteth Street, Liverpool, released October 30th, 1929.

L. J. Coller (J. & F. Coller), electrical engineer, 63, Henton Road, Leicester.—Receiving order made February 25th, on debtor's own petition.

A. H. Crump (Selwyn Electrical Engineering Co.), 202 and 220, Walworth Road, S.E.—Trustee, Mr. W. J. H. Boyle, Senior Official Receiver, Carey Street, W.C., released February 12th.

J. Roysental, electrical engineer, 46, Woodberry Grove, Finsbury Park, N.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released February 12th.

J. E. Dawson, wireless engineer, High Street, Boston.—Trustee, Mr. C. G. Compton, 5, Church Close, Boston, released January 23rd.

J. B. Wickstead, R. J. Allen, and L. Knight (C. Cooper and Co.), plumbers and electrical engineers, &c., 26, King Street, Stretford.—Trustee, Mr. A. C. Eaves, 47, Mosley Street, Manchester, released February 15th.

T. Barnett, electrical contractor, 6, St. Peter's Church Walk and High Street, Stanton Hill, near Mansfield, Nottingham.—First and final dividend of 7d. in the £, payable March 19th, at 18, Low Pavement, Nottingham.

O. C. Lay (Wireless Installation Co.), accumulator specialist, 2c and 2d, High Street, Wandsworth, S.W.—Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C., released February 12th.

V. H. Bates (Linton Radio Service), wireless engineer, High Street, Linton, Cambs.—Last day for proofs for dividend March 14th. Trustee, Mr. F. H. Langmaid, Official Receiver, 41, Sidney Street, Cambridge.

T. E. Jones (B. Jones), electrical engineer, 138, Northgate Street, Chester.—First and final dividend of 5s. 4d. in the £, payable at 5, Hunter Street, Chester.

H. Gateshill, wireless engineer, 113, Witham, Kingston-upon-Hull.—First and final dividend of 8d. in the £, payable at the Official Receiver's office, 37, Scale Lane, Hull.

Company Liquidations.

Pye (Radio), Ltd.—With reference to the note in our issue of February 21st (p. 347) regarding the winding up of Pye (Radio), Ltd., Pye Radio, Ltd., points out that the two concerns should not be confused. The company which is being wound up was registered shortly before the flotation of Pye Radio, Ltd., in order to protect the name. It has never carried on business, and having now fulfilled its function, is being wound up.

Edison Illuminating, Ltd., 55, Victoria Street, S.W.1, electrical and wireless factors.—A meeting of creditors was held on February 27th at the offices of Messrs. Hacker, Rubens, Horner & Co., 23, Surrey Street, W.C.2, when Mr. Gotelee, liquidator, submitted a statement of affairs showing liabilities of £1,817, and assets of £142, leaving a deficiency of £1,675. Mr. R. Alfred, managing director, presided at the meeting. The liquidator said that the company was formed in 1927 with a capital of £400, all of which was issued for cash. The principal commodity of the company was the "Sun-Glo" lamp which was obtained from America; in frequent cases when supplies arrived in this country, many were broken, and consequently a number of the orders had to be cancelled. In November, 1928, it was arranged that the supplies should be obtained in this country and the consignments from America cancelled. By that time, however, the working capital of the company had been expended, and although the directors obtained a further £200, it proved totally inadequate. The managing director, however, was satisfied that the product was a good one, and several substantial contracts were practically completed, and he considered that if he were allowed to carry on the business it could be conducted successfully in the future. With that end in view, he was prepared to offer the creditors a royalty of 7½ per cent. on all future sales, until 10s. in the £ had been paid. He considered that the full amount would be paid in less than two years. It was decided that the liquidation should be continued with Mr. Gotelee as liquidator, and a committee of inspection consisting of the representatives of two of the largest creditors was appointed. The following are creditors:—

	£		£
British Thomson-Houston Co., Ltd.	128	Rolls-Caydon	32
British Labresse Co., Ltd.	39	Deans, John	50
Garnett, Whiteley & Co.	234	Howard, Lawrence & Co.	50
Ide, F. & W.	25	Jonas, Douglas H. ...	63

Faradex-Seraphone Co., Ltd., 25-27, Portpool Lane, Gray's Inn Road, W.C.—The statutory first meetings of the creditors and shareholders were held on February 25th at Carey Street, W.C., before Mr. G. Digby Pepys, Senior Official Receiver. The company was formed in April, 1929, to acquire the goodwill and assets of Rooke Bros., Ltd., and the Seraphone Co., Ltd., radio manufacturers, &c. The nominal capital was £125,000 in 2s. shares, of which 350,000 were issued as fully paid and 750,000 were issued for cash. The unpaid calls amounted to £64,627. The consideration payable to Rooke Bros., Ltd., was £15,000 in cash and £25,000 in shares, and the Seraphone Co., Ltd.'s consideration was £5,000 in cash and £10,000 in shares. Except for £2,000 paid to Rooke Bros., Ltd., no part of the cash consideration had been paid. In April last the company publicly offered 750,000 shares of 2s. each, but was unsuccessful. Although judgment was obtained against certain underwriters no amount appears to have been recovered. The company never commenced business, the agreements with the vendors were not completed, and as a result the vendors did not transfer the property. The directors attribute the failure of the company to the sub-underwriters failing to meet their obligations. The liabilities are estimated to amount to £13,892 and the only asset is the unpaid calls, £64,627, estimated to produce £2,099. Mr. K. A. Leyton-Bennett was appointed liquidator by the creditors.

Artandia, Ltd., Pittshead Mews, Park Lane, W.—The statutory first meetings of the creditors and shareholders under this compulsory liquidation were held on February 28th at Carey Street. Mr. H. P. Naunton, Assistant Receiver, reported that the company was formed in May, 1927, with a nominal capital of £26,250 to acquire patents relating to sound-producing and amplifying apparatus and to carry on business as manufacturers of loud-speakers and gramophones. In July, 1927, the Marquis de Andea Yvarrazaval sold the company certain letters patent for loud-speakers for £15,450 cash and 5,000 1s. shares. Eventually the Marquis purchased the whole of the shares and debentures held by a group.

The company apparently did little or no business, and a balance-sheet dated December, 1928, showed a net loss of £7,605. It (the company) had been involved in numerous legal actions, and the failure was attributed to dissensions between the directions and to the very heavy price paid for the patents. The accounts showed assets of £3,445 (entirely absorbed in the claims of the debenture holders) and liabilities of £5,398; the deficiency of assets to meet liabilities was returned at £1,947, and the total deficiency with regard to contributories at £29,749. The liquidation was left in the hands of the Official Receiver.

Refrigerators, Ltd., Manchester.—A meeting of the creditors of the above was held last week at Manchester, when it was reported that the shareholders had passed a resolution for voluntary liquidation with Mr. C. Chambers, as liquidator. The statement of affairs showed liabilities of £2,068 and net assets of £162, leaving a deficiency of £1,906. The company was registered in 1923, and its issued capital was £2,000, fully paid. During 1926 a profit was earned, but in succeeding years there were losses. The present position was attributed to lack of capital. The voluntary liquidation of the company was confirmed with Mr. Chambers as liquidator.

Dionoid Battery Co., Ltd.—Particulars of claims by March 31st to the Liquidator, Mr. B. C. Davies, 6, East Parade, Sheffield.

Gravesend & Northfleet Electric Tramways, Ltd.—Winding up voluntarily. Liquidators, Messrs. T. Bower and T. H. Underhill, 88, Kingsway, W.C.

British Hele-Shaw Patent Clutch Co., Ltd.—A meeting of members is called for March 26th, at Hartford New Works, Featherstall Road South, Oldham, to hear an account of the winding up from the liquidator, Mr. W. H. Kelsall.

Arctic Electric Supplies, Ltd.—A meeting of creditors is called for March 10th at Anderton's Hotel, Fleet Street, for the purpose, if thought fit, of nominating a liquidator and of appointing a committee of inspection.

Staffordshire Electrical Accessories Co., Ltd.—A meeting of creditors is called for March 11th at 10, Cheapside, Hanley, for the purpose, if thought fit, of nominating a liquidator and of appointing a committee of inspection.

Dissolutions of Partnership.

Union Electric Co., electrical engineers and contractors, Falcon House, 61, Eagle Street, High Holborn, W.C.1.—Mr. H. N. Kaye and Mr. H. C. Shot have dissolved partnership. Mr. Kaye will attend to debts and continue the business.

Premier Electrical Supplies Co., electrical factors, 6, Millergate, Bradford.—Messrs. H. Taylor, K. B. Joist, and N. Robinson have dissolved partnership.

Private Arrangements.

S. Kershaw and H. Ormian, trading as S. Kershaw & Co., Broad Lane, West Derby, and 4, Daulby Street, Liverpool, electrical and radio engineers.—A meeting of the creditors was held on February 24th at the offices of Mr. P. S. Booth, Exchange Chambers, Bixteth Street, Liverpool. The statement of affairs showed liabilities of £445 and net assets of £249, leaving a deficiency of £196. Neither of the partners possesses any separate estate. The debtors commenced trading in partnership in January, 1929. Kershaw brought in stock to the value of £75, and Ormian £50. During the year to January 31st the turnover was approximately £1,000, the expenses being £266, whilst the partners between them had only drawn £2 10s. a week. A resolution was passed confirming the deed of assignment already executed to Mr. Booth. A committee was also appointed to confer with the debtors and their friends with a view to a composition being submitted. The following are creditors:—

	£		£
Downes & Davies ...	25	Richardson & Co.	59
English Cable Supplies	51	Howitt & Co.	35
Kolster-Brandes, Ltd.	60	Stern Electrical Co. ...	21

William Woodman, electrical contractor, trading as T. Woodman & Co., 44, Norton Street, Liverpool.—A meeting of creditors was held on February 27th at the offices of Mr. P. S. Booth, Exchange Chambers, Bixteth Street, Liverpool. The statement of affairs showed ranking liabilities of £1,004 and

net assets of £530, leaving a deficiency of £474. The debtor commenced trading about six years ago with a capital of £400, having purchased a business previously carried on by a relative. It was resolved that the matter should be dealt with under a deed of assignment already executed to Mr. Booth, and a committee was appointed consisting of the representatives of three of the principal creditors. The following are creditors:—

	£		£
General Electric Co., Ltd.	271	Falk, Stadelmann & Co., Ltd.	31
Electric Conduits, Ltd....	254	Broughton & Cleator ...	35
W. T. Henley's Telegraph Works Co., Ltd. ...	85		

Winding-up Petitions.

IN the Companies Court on March 3rd, Mr. Justice Maugham had before him the petition of the Chloride Electrical Storage Co., Ltd., for the compulsory winding up of British Talking Pictures, Ltd., which had been adjourned for a month.

Mr. CECIL TURNER, for the petitioners, said the respondents had large assets in the form of receivable rents. On the last occasion his Lordship appointed a provisional liquidator, and in the interval a scheme had been drafted, which had been considered by the parties, who all agreed to the petition being adjourned for another month to allow of the scheme being further considered.

Mr. Hecksher and Mr. Hunt, representing creditors for £150,000, including the General Electric Co., Ltd., and the Kershaw Projector Co. agreed to an adjournment.

His LORDSHIP stood the petition over for another month.

On the same day, Mr. Justice Maugham heard the petition of Mr. W. D. Stevens, Cazenove Road, Stamford Hill, for the compulsory liquidation of the Wynsor Electric Range Co., Ltd.

A director of the company said that he was in touch with a financier who was prepared to put up money if he could investigate the company's affairs. But it had been impossible to hold a board meeting, as there were only two directors, and the other director was the petitioner.

Mr. HECKSHER, for the petitioner, said he understood that his client had resigned his directorship, but the other director replied that under the articles he had no power to resign.

His LORDSHIP adjourned the petition for 14 days, and said it appeared doubtful from the articles whether the petitioner could, or ought to, resign his directorship before another director had been appointed.

Mr. Justice Maugham adjourned for four weeks a petition for the compulsory liquidation of the Halcyon Wireless Co., Ltd., presented by Bullmores, Ltd.

Mr. HECKSCHER, for the respondent company, said there was some chance of money being raised to pay the company's debts, and a scheme being approved which would benefit the creditors.

The same Judge also ordered an adjournment for 14 days of the petition by the Plessey Co., Ltd., for the compulsory liquidation of the Symphony Gramophone & Radio Co., Ltd.

Sir GERALD HURST, K.C., for the petitioners, said that a meeting of creditors took place on February 28th to consider a scheme of re-arrangement, and a majority approved the scheme on condition that £50,000 was forthcoming within 14 days. He asked for a further adjournment to allow the scheme to be considered by the shareholders and others concerned.

New Catalogues and Lists.

Messrs. CHARLES LATHE & Co., LTD., Moat Foundry, Tipton.—A fully illustrated and price catalogue of "Claco" domestic appliances, including fires, cookers, irons, kettles, toasters, boiling stools, &c.

Messrs. F. GILMAN (B.S.T.) LTD., 221, High Street, Smethwick.—An illustrated brochure giving instructions for every type of scaling with the aid of the company's tools, and describing new high-speed gear-driven machines and new scaling tools.

ELECTRICAL POWER ENGINEERING CO. (BIRMINGHAM), LTD., Fetter House, Fetter Lane, E.C.4.—A loose-leaf catalogue dealing with a.c. motors, heavy current generators and lighting plants. Also a leaflet referring to heavy current generators. Illustrated and priced.

UNDERFEED STOKER CO., LTD., Africa House, Kingsway, W.C.—An illustrated pamphlet giving brief particulars of the "Duo-Mass" vibro-conveyor.

GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The February issue of the "Osram-G.E.C. Bulletin" contains a number of interesting articles relating to the company's products, including the lighting of Brighton Aquarium, the lighting of kinemas, the British Industries Fair, &c.

Messrs. WALKER BROS. (ELECTRICAL ENGINEERS), LTD., Quality House, Temple Row, Birmingham.—The "Electrical News" for February includes a number of interesting articles on the company's activities.

PETTERS, LTD., Yeovil.—A copy of a report on a test carried out by Mr. W. A. Tookey, M.Cons.E., on a Petter Atomic Diesel engine.

SUFFOLK IRON FOUNDRY (1920) LTD., Stowmarket.—A well-produced and illustrated booklet dealing with "Ferro-Silicon," "Super-Silicon," and "Sifbronze" welding rods, and presenting an operator's guide to the use of the company's products.

BAXTER & CAUNTER, LTD., 219, Tottenham Court Road, W.1.—An illustrated price list for March of the company's electrical accessories.

CROMPTON PARKINSON, LTD., Guiseley, Leeds.—An illustrated leaflet describing controller pattern instruments. Also Specification No. A302, illustrating and describing the company's "Class F" d.c. motors and generators.

BENJAMIN ELECTRIC, LTD., Brantwood Works, Tariff Road, Tottenham, N.17.—Illustrated leaflet No. 1110, describing the company's installation of lighting reflectors at the factory of Messrs. J. S. Fry & Sons, Ltd.

STANDARD SWITCHGEAR LTD. (J. B. Rudkin), 59, New Oxford Street, W.C.1.—Two illustrated leaflets dealing with the company's specialities for rural distribution, and its oscillation-limiter for surge protection.

BROOKHIRST SWITCHGEAR, LTD. ,Northgate Works, Chester.—Leaflets Nos. 284 and 287, dealing, respectively, with the company's control gear and multi-speed squirrel-cage motor starters.

Messrs. BRUCE PEEBLES & Co., LTD., Edinburgh.—Leaflet No. 172, containing illustrated particulars of marine-type dynamos and motors.

Messrs. GEORGE ELLISON, LTD., Perry Barr, Birmingham.—Two illustrated brochures describing oil-break star-delta starters for squirrel-cage induction motors and totally-enclosed unit-type draw-out switchgear.

Messrs. W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1.—Pamphlet U.D.A., describing a new standard e.h.p. cable joint, together with catalogue U.D.2, giving full details for ordering. Also a pocket booklet for jointers and supply engineers showing each step in the making of an e.h.p. cable joint.

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Mar. 4th.	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5½d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£33	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£25	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... ... per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£15 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3½d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net	£158	£4 dec.
	Grade II... ... ... ,, ,,	£112	£3 dec.
	Grade III ... ... ,, ,,	£64	£1 dec.
c	Brass (rolled metal 2" to 12" basis) per lb.	10½d.	½d. dec.
c	,, Tubes (solid drawn) ... ,,	1/0½ to 1/1	...
c	,, Wire, basis ... ... ,,	10½d.	...
c	Copper Tubes (solid drawn) ... ,,	1/8	...
g	,, Bars (best selected) ... per ton	£110	...
g	,, Sheet ... ... ,,	£110	...
g	,, Rod ... ... ,,	£110	...
d	,, (Electrolytic) Bars ... ,,	£84 7s. 6d.	2s. 6d. inc.
d	,, ,, Sheets ... ,,	£113 10s.	...
d	,, ,, Wire Rods ,,	£94 7s. 6d.	2s. 6d. inc.
d	,, ,, H.C. Wire per lb.	11¼d.	...
f	Ebonite Rod... ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/1	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	9d.	½d. dec.
i	Iron, Pig (Cleveland No. 3.) ... per ton	72/-	6d. dec.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£21 5s.	25s. dec.
g	Mercury ... ... per bot.	£23	2s. 6d. dec.
e	Mica (in original cases) small ... per lb.	6d. to 2/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/9½	...
p	,, ,, drawn bars & rods ,,	1/5	...
p	,, ,, rolled strip & sheet ,,	1/9½	...
p	,, ,, wire... ... ... ,,	1/6	...
o	Platinum ... ... per oz.	£12	...
e	Silicium Bronze Wire ... ... per lb.	1/2	...
r	Steel, Magnet, in bars ... ... ,,	7½d.	...
g	Tin, Block (English) ... ... per ton	£167 15s. to £168 5s.	£8 15s. dec.
n	Wire, Nos. 1 to 16 ... ... per lb.	2/5	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co. state in their letter dated March 1st that lead prices fluctuated last week. The situation is an extraordinary one: a glut of lead, accompanied by a premium for prompt, a tottering market in which the chief buyers are producing interests, while the principal sellers are consumers, evidently hedging operations against considerable stocks of manufactured material. Demand everywhere remains very quiet, while supplies are excessive and arrivals show no signs of lessening.

Trade Announcements.

Mr. S. Schneider, 3, Hanover Court, Moor Lane, E.C.2, who, we understand, holds the sole selling rights for Great Britain, the Dominions and Colonies, for "Mary Ann" vacuum cleaners, has instituted, through wholesalers, a stock bonus scheme for retailers of these machines.

Messrs. A. J. Evans and M. A. Frost have formed a partnership under the name of Frost & Evans, at 71, Carlingford Road, Tottenham, N.15, as factors for the sale of instrument wires and electrical and wireless accessories.

Benjamin Electric, Ltd., announces that Mr. Towers, its representative for Northumberland, Durham, Cumberland and Westmorland, has moved to 5, Grosvenor Drive, Whitley Bay, Northumberland.

Messrs. S. Thomas Pemberton & Co., 8, Church Street, Colmore Row, Birmingham, have recently been appointed to represent Messrs. Bruce Peebles & Co., Ltd., in the Midland Counties. Mr. S. T. Pemberton has for the last 28 years been the representative of Electromotors, Ltd., in the same area.

The Whitworth Electric Lamp Co., Ltd., 6 and 8, Gorleston Street, West Kensington, W.14, announces that it has formed a subsidiary company to carry out repairs to domestic electrical appliances.

British Electric Fans for India.

Messrs. Veritys, Ltd., have again been successful in obtaining the Indian Stores Department contract for the next two years, for d.c. and a.c. ceiling fans, the types selected being the "Ceylon" (d.c.), "Alipore," and "Karachi" (a.c.). Large orders have been received for these fans, and the company's works at Aston continue to be fully employed.

Lighting and Power Notes.

Australia.—Tasmania.—The report of the Tasmanian Hydro-Electric Department for the year ended June 30th last shows a gross revenue of £315,621, as compared with £288,388 in the preceding year. The working expenditure increased from £45,311 to £52,245, leaving a gross profit of £263,376 (£243,077), to which was added £139 interest on loans, making a total of £263,515 available. After providing for interest on loans (£191,406), depreciation (£31,105), writing down of plant and stores (£17,175), and bad debts (£102), there was a net surplus of £23,726. The capital expenditure during the year amounted to £56,624, making the total now spent by the Department £3,592,535. Proposals have been made to all municipalities taking a bulk supply that the Department should absorb their undertakings. Several municipalities have accepted the offer, while others are still considering it. Considerable success has resulted from the Department's policy of developing the electric cooker business. A start has been made with the completion of the Shannon scheme, and it is hoped to have the scheme in operation by the beginning of next year.

Victoria.—The returns of the State Electricity Commission for the quarter ended December 31st last show a total revenue of £470,610, as compared with £402,071 in the corresponding period of 1928. The expenditure increased from £399,345 to £469,252, leaving a profit of £1,358 (£2,726). Sales of electricity increased from 90,609,033 to 98,766,457 kWh, and the maximum supply demanded from 79,882 to 85,356 kW. The Ballerat-Bendigo-Geelong ring main has now been constructed as far as Castlemaine and 147 towns now take their electricity supplies from the Commission.

Power Station Extensions.—The Adelaide Electric Supply Co., Ltd., is making steady progress with the extensions of plant at its Osborne power station, says the *Electrical Engineer of Australia and New Zealand*. The new 15,000-kW turbo-alternator supplied by the General Electric Co., Ltd., London, is in position and ready to go on load. Preparations are being made for the installation of the 10,000-kW Metropolitan-Vickers machine now on order. To make room for this unit one of the 5,000-kW sets was removed.

Barking.—Electricity Loan.—The Urban District Council Electricity Committee is applying for sanction to the borrowing of £18,527 in connection with the electricity supply to Becontree estate.

Barnes.—Power Station Extensions Refused.—As a result of an inquiry held last November, the Electricity Commissioners have decided to refuse their consent to the extension of the Urban District Council's generating station and to the raising of loans in connection therewith.

Coatbridge.—Electricity Supply.—A scheme has been prepared for the taking over by the Town Council of the electricity undertaking, and a committee is to interview the Electricity Commissioners to put before them offers by two electrical companies, and to obtain the views of the Commissioners regarding the offers and legal difficulties which have arisen during the negotiations with the companies.

Continental.—Spain.—The Minister of Public Works is at present studying the request made during the dictatorship by foreign companies for the institution of an electric power monopoly.—*Reuter* (Madrid).

Sweden.—Statistics published by Svenska Elektricitetsverksfoeringen show that the production of electric power in Sweden increased during 1929 by 475 million kWh as compared with 1928, to 4,850 million kWh. The increase in the production of power was greatest in North Sweden, where certain industries are large consumers. In Central Sweden, where no new sources of power of importance were inaugurated during the year, the increase in consumption was about 14 per cent., while in Southern Sweden there was a decrease of about 6 per cent. owing to shortage of water.—*Reuter's Trade Service* (Stockholm).

Italy.—La Società Idro-elettrica del Littorio has recently secured concessions to establish three hydro-electric stations in the province of Vercilli of 4,980-h.p., 5,790-h.p., and 36,280-h.p. capacity at Riva Valdobbia, Alagna, and Sessia, respectively.

Crediton.—Sale of Undertaking.—The Urban District Council has decided to sell its electricity undertaking to the Exe Valley Electricity Company for £15,000, subject to the price per kWh being 9d., a reduction of 1d. on the price now being charged by the Council. The performance of the contract is guaranteed by Whitehall Securities Corporation, Ltd., which it was stated had taken over the Sidmouth, Southmolton and Honiton undertakings, and would probably be taking over others in the neighbourhood of Crediton. The Council is making a profit of nearly £4,000 on the transaction.

Dover.—Electricity Supply.—At a meeting of the Town Council held recently a report was given of the interview between the Electricity Commissioners and the delegation appointed in connection with the Council's application for sanction to the installation of a 1,500-kW turbo-generator at the Electricity Works. It was stated that the output was not the main question. The Commissioners requested the Corporation to furnish a statement showing the estimate of the cost of electricity for seven years if generated by the Corporation and if a bulk supply was taken. If the Commissioners were satisfied that the generated electricity would be cheaper, they would hold an inquiry, but they were not prepared to sanction any further plant. Bulk supply would be available in October, and the £6,000 offered towards the cost of change of frequency would not be granted if the bulk supply was not taken then. The terms upon which the bulk supply was offered were the maximum, and when the grid price was fixed, it might be less, particularly after the end of the first seven years.

Eastbourne.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to loans of £5,334 in respect of mains for parade lighting, and £23,604 for switchgear and transformers required in connection with the bulk supply of electricity.

Electricity Supply Extension.—The Corporation Electricity Committee is considering a supply to Birling Gap at a cost of £2,550.

Guildford.—Mains Extensions.—The Corporation Electricity Committee is to extend mains to supply Godwin Austen Estate, Pilgrim's Way and Nursery Estate, Manor Road, at a total cost of £595. The Committee has also decided that in view of the heavy increase of the load in Epsom Road, the main shall be replaced by a larger one, at an estimated cost of £656. With regard to an application from Messrs. Messenger and Morgan to complete the laying of mains on the Farnham Road estate, the Committee has decided that, having regard to the fact that this estate is not being developed rapidly, the owners be requested to bear 75 per cent. of the estimated cost (£762).

Street Lighting.—The Committee recommends central lighting for the High Street.

Hiring of Apparatus.—The Committee has asked a sub-committee to consider the question of letting out cookers and heaters on hire.

Heston and Isleworth.—Mains Extensions.—The Urban District Council has approved a recommendation by the Electricity Committee for the extension of mains as follows:—For 820 houses to be erected on a new estate between Hall Road and Heath Road; for a factory in Belgrave Road for Metalfilters (1929), Ltd.; for 28 houses to be erected in Worton Avenue; and for the new air-compressor plant at the sewage works, at a total estimated cost of £60,241.

Hull.—Revision of Electricity Tariff.—The Corporation Electricity Department has adopted recommendations by the electrical engineer that as from the final reading for the current financial year no charge shall be made for the rent of meters, and that the domestic tariff kWh charge shall be ½d. for the whole area of supply.

Street Lighting.—The Town Council has instructed the Works Committee to proceed with the preparation of a programme for the gradual supersession of the existing gas lamps used for street lighting purposes by electric lamp standards, particularly in the main thoroughfares of the city. Further, the Committee is instructed that, where practicable, no additional gas lamps shall be erected, and electricity shall be used in all new streets and estates where a supply is available.

Long Eaton.—Electricity Supply Extensions.—The Urban District Council Electricity Committee is to give a supply of electricity to the L.M.S. Toton sidings, and by a h.p. main from Braedon Street to the New Sawley sub-station

at an estimated cost of £2,822. The Committee also recommends the supply of electricity to Old Sawley at an estimated cost of £1,030. A sub-station is to be erected in Bennett Street at a cost of £4,065, including the necessary transformers and equipment.

Maidstone.—MAINS EXTENSIONS.—The Town Council is to extend mains to East Malling at an estimated cost of £3,500. Mains at Ditton Corner are also to be linked up with extensions at Aylesford at a cost of £1,060, and street lighting mains are to be laid at Ditton at an outlay of £500.

Preston.—ELECTRICITY SUPPLY EXTENSIONS.—At a recent meeting of the Town Council approval was given to an application for sanction to the following loans:—6,000-V feeder main to Greenback, £6,936; pipes under river for carrying cables, £2,400; 2,000-V feeder main to Cottam, £2,926; 2,000-V feeder main to Ashton, £1,057; 2,000-V feeder main to Cadley, £1,743; main for Deepdale housing scheme, £2,368; total, £17,430. It was agreed, subject to a grant from the Unemployment Grants Committee, that the Longton ring main should be extended at a cost of £3,717; and that application should be made to the Electricity Commissioners for borrowing powers. Also, subject to the same consideration, a proposal to extend supplies to the north and north-east of the present area was approved. It was also proposed to lay six additional pipes under the river to secure an adequate supply for future development.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

MAIDSTONE.—Lighting flat rate: From 5½d. to 4½d. per kWh. Two-part tariff "unit" charge: From 2d. to 1½d. per kWh. Contract demand system: From 17s. to 16s. per 30-watt lamp per annum. It is also recommended that no rent be charged for meters on circuits where an electric cooker is installed, and that when a hired cooker is installed the necessary wiring up to length of 20 ft. should be provided free of charge.

MEXBOROUGH.—Lighting flat rate: From 5½d. to 4½d. per kWh.

LONDON.—*North Metropolitan Electric Power Supply Co.*—Lighting flat rate: A reduction of ½d. per kWh in the near districts and 1d. per kWh in the more remote districts.

ELGIN.—Lighting: From 9d. to 8d. per kWh. Power: From 4d. to 3d. per kWh.

WEST WICKHAM.—Lighting flat rate: From 8d. to 7d. per kWh.

Reigate.—STREET LIGHTING.—The Town Council has decided to have fifty gas lamps in the borough converted to electricity.

Seaham Harbour.—ALTERNATIVE SUPPLY SCHEME.—The Urban District Council Electricity Committee has approved a scheme submitted by the engineer for the provision of an alternative source of supply, at an approximate cost of £4,000.

SUPPLY TO HOUSING ESTATE.—The Urban District Council Housing Committee has decided to invite the electrical engineer to submit a tender for the wiring of the 80 cottages now in course of erection on Carr House Estate.

Shipley.—MAINS EXTENSIONS.—The Urban District Council Electricity Committee is seeking sanction to the borrowing of £10,000 for new mains.

Southwick.—INQUIRY.—A Government inquiry was held at Southwick on February 27th into the application by the Central Electricity Board for permission to erect overhead lines from Southwick to Hurstpierpoint. The scheme was opposed by the East Sussex County Council, the Society of Sussex Downsmen, and the Council for the Preservation of Rural England. The proposed line, it was stated, would pass within a mile of the Devil's Dyke. It was suggested by the opponents that the line should be placed underground, but the Electricity Board objected on the ground that the cost of the excavation work would be £2,347 a mile. The County Council, however, stated that the cost would be only £480 a mile. It was also suggested that the line should be carried through the Weald.

Special Orders.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the Aylesbury Corporation to supply electricity in the parish of Bradenham in the rural district of Wycombe, and the St. Helen's Corporation to supply electricity in the township of Bold in the rural district of Whiston and part of the township of Burtonwood in the rural district of Warrington.

Stoke-on-Trent.—LOAN APPLICATION WITHDRAWN.—The Corporation Electricity Committee has withdrawn its application for sanction to a loan of £50,000 in connection with the overhead transmission lines to Market Drayton and Stafford proposed to be erected by the Corporation on behalf of the North-West Midlands Joint Electricity Authority.

NEW SUB-STATIONS.—The Committee has obtained land for a sub-station at Strongford and decided to apply for sanction to the borrowing of £2,500 for its erection and equipment. The Committee has also approved plans for the erection of a sub-station in Kingsway, at a cost of £1,500.

MAINS EXTENSIONS.—The Committee is to extend mains to supply 40 houses to be erected by Messrs. Shenton Bros. in a new road off Milton Road, Sneyd Green.

Swansea.—YEAR'S WORKING.—The Corporation Electricity Department's accounts for last year disclose a deficit of £3,931. On the expenditure side the principal item is £60,000 in respect of generation costs. This compares with an estimated expenditure of £58,000, the deficit being chiefly due to two items of £10,996 in respect of capital expenditure out of revenue and £4,223 in respect of new sites. Last year the sum of £3,150 was transferred to the rates, but this year the Committee states that it is not possible to make any transfer.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to *Power*, plans for a $6,000,000 hydro-electric power development have been revealed by an application filed recently with the Washington State Hydraulics Office for appropriation of 3,500 sec. ft. of water from the Sauk River, Skagit County, and for the use of Sauk Lake as a reservoir, by the Pacific Development Company, of Olympia. A concrete dam 220 ft. high and 1,200 ft. long is to impound 380,000 acre-ft. of water in Sauk Lake reservoir, while a fall of 185 ft. is to be used to develop 73,580 theoretical h.p. of electrical energy.

Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—According to the *Railway Gazette* the proposals recently submitted to the Buenos Aires Municipality by a British and a Spanish syndicate, respectively, for the construction of a system of underground transport, have been followed by another scheme emanating from two Argentine-German companies, the Compañia Argentina de Electricidad, and the Compañia General de Obras Públicas, both of which are off-shoots of the A.E.G. The scheme, one of the most extensive yet submitted to the municipal authorities, provides for the construction of 11 lines in all, with a total length of 100 km. of route. The total cost of the work is estimated at $561,607,081.

Ashton.—LOAN.—The Corporation Tramways Committee is applying for sanction to a loan of £10,000 for the purchase of railless cars and 'buses.

Cheltenham.—TRAMWAY ABANDONMENT.—The Corporation has come to an agreement with the Cheltenham District Traction Co. as to the abandonment of the tramways. The company is to discontinue the use of the existing trams on the Prestbury route and the Leckhampton route not later than the end of the current month, and the remainder of the light railways within the borough not later than March 31st, 1931. The Corporation agrees not to exercise its right to purchase the undertaking in 1931 under the provision of the Cheltenham District Traction Act, 1929.

Continental.—SWEDEN.—While the problem of the continued electrification of the Swedish State Railways is being investigated and discussed, the Government is being asked for an allowance to prepare for the electrification of the Gothenburg-Boraas Railway, 221 km. in length, at an estimated cost of kr. 3,500,000. At first only seven electric locomotives and three motor coaches would be bought.—*Reuter's Trade Service* (Stockholm).

ITALY.—A new electric railway has recently been completed and put in operation between the Adige Valley and the Dolomites. The Società dei Tramvie Elettriche Bresciana has decided to electrify the tramway between Orzinuovi and Soncino.

Edinburgh.—PURCHASE OF TRAMWAY LINE.—A letter has been received by the Town Clerk from the Musselburgh and District Electric Light and Traction Co., Ltd., suggesting the purchase by the corporation of the tramway line between Joppa and Port Seton and also the company's interest in the 'bus service between Edinburgh and Port Seton. The letter is to be considered by the Transport Committee.

Glasgow.—A TRAMCAR INDICATOR.—According to the *Daily Despatch*, a Glasgow engineer's invention for making tramway travel easier is to be adopted experimentally by the Corporation tramway undertaking. After three years' research Mr. J. Whitfield, the inventor, has perfected electrical apparatus which automatically indicates each stopping-place to tramway passengers. The apparatus, which operates as the tramcar trolley engages with contacts on the conductor wires, flashes the name of the next stopping place on an illuminated banner fixed at each end of the car. Warning of a stage-point is given about 30 yards before the stop, while the name of the next stage-point is indicated.

London.—TRAMCAR RECONDITIONING.—The Metropolitan Electric Tramways, Ltd., is to equip 60 cars with high-speed motors, cross seats, improved lighting, &c., at £37,000; fit roof covers to 79 open top deck cars at £25,000; re-motor, fit line switches, recondition, improve illumination, and fit cross seats to 72 cars at £42,000; and provide feeders to connect the track with new sub-stations at a cost of £4,850.

Manchester.—TRAMCAR SAFETY SIGNALS.—Experiments are being carried out on the Corporation's tramcars with an automatic signalling device.

Nottingham.—Railless-car Inauguration.—The tramway along St. Ann's Well Road and Wilford Road has been replaced recently by railless cars.

Southern Railway.—Electrification Extension Schemes.—At the annual general meeting of the Southern Railway Company held at the Cannon Street Hotel, London, on February 27th, much interesting information was given regarding the company's policy of extending its electrified system. As announced in October last, the board has decided, upon the remission of the Railway Passenger Duty, to proceed with the electrification of the line from London to Brighton and Worthing. For operation on these routes it has been agreed to utilise the third-rail system working at a pressure of 660 V in preference to a system worked by means of overhead conductors at a maximum pressure of 1,500 V. Nearly 800 miles of line have already been electrified at 660 V, so that by using this standard voltage for the extension it will be possible to bring suburban trains into use for excursion and week-end traffic, thus saving a large sum in the construction of new vehicles. Another important question that has been under consideration has been whether the new trains should be operated by electric locomotives or on the multiple unit system. The board has come to the conclusion that the latter system has many advantages for a scheme of this type, and has decided to adopt it, treating the scheme rather as an extension of the suburban system than as a main line electrification. It is proposed that south of Coulsdon electricity shall be obtained from the Grid, and this will be supplied through substations at Croydon, Three Bridges, and Southwich. The steam train mileage that will be discontinued amounts to about 1,972,000 per annum, and it is proposed to substitute for this an electric train service with a mileage of approximately 4,921,000. The total cost of the whole scheme, including the re-signalling of the line from Purley to Brighton, is estimated at £2,700,000, of which approximately a half is to be charged to capital. The scheme is expected to be completed in 1932. With regard to other electrification schemes, the Wimbledon-Sutton line has been completed and three other electrical extensions are in course of completion, *viz.*, between Wimbledon and West Croydon, from Hounslow and Twickenham to Windsor, and from Dartford to Gravesend. It is hoped that all the services will be open for traffic by the summer. Nearly 800 miles of line has already been electrified, and the results obtained have proved exceedingly satisfactory. The working expenses during the last two years have been reduced by £1,000,000.

Telegraph and Telephone Notes.

Beam Radio-telephony.—Government's Decision.—Mr. Lees-Smith, Postmaster-General, announced in the House of Commons last week the Government's decision not to make use of the Marconi beam system of wireless telephony. Last August he received a letter from Imperial and International Communications, Ltd., urging that the Government should decide to work overseas telephony through the company's stations, beginning with four services from England to Canada, Australia, South Africa, and India. The alternative was to concentrate all the wireless telephone services at the Government station at Rugby. The Government consulted two independent experts, who had no connection with the Post Office (Professor G. W. Howe, Glasgow University, and Dr. F. E. Smith, Secretary of the Royal Society and of the Department of Scientific and Industrial Research). They reported that both systems were probably equally capable of providing satisfactory telephone communication between two points for a given number of hours a day, but as regarded future developments the Rugby system was more elastic, and, therefore, offered decided advantages.

Regarding the financial comparison between the two systems, by grouping services at one centre fewer land lines would suffice. To work the four services through the beam stations at Bodmin, Grimsby, Bridgwater, and Skegness, 4,190 miles of high-grade telephone circuit would be required, while to work through the stations at Rugby and Baldock only 785 miles would be required. The minimum rental asked for by the company for the use of the beam stations was from £40,000 to £45,000 a year, according to the type of equipment employed, plus ten per cent. on the gross receipts in excess of a certain figure. A detailed estimate of the cost of working the same services from Rugby showed a saving on these figures of £17,000 a year and £22,000 a year, respectively, which would be increased when the royalty began to operate. The Government, therefore, had decided upon the policy of conducting overseas wireless telephony by concentration at the Post Office transmitting station at Rugby and its receiving station at Baldock.

Egypt.—Automatic Telephony.—The Egyptian Ministry of Communications is reported to have approved of a proposal to convert the telephone exchanges throughout the country to automatic working.

Hull.—Telephone Profit.—It is estimated that the municipal telephone service will result in a profit of £11,516 this year. It is declared that the undertaking is saving subscribers £50,000 per year, compared with the tariff that would have been charged had the service passed under the control of the State.

International Telephony.—Greece.—Negotiations are proceeding for the establishment of telephone communication between Athens and Berlin. A service to Belgrade will be opened in March.

Ship-Shore Telephony.—Atlantic Service.—The equipment for the new public service announced in our February 21st issue (p. 350) was made by Standard Telephones & Cables, Ltd., to the order of the International Marine Radio Co., Ltd., and the British Post Office. The wavelengths used depend on the distance to be covered and the time of day, those actually employed on the White Star Co.'s liner *Majestic* being 33, 26, and 17 metres; the last-named is the most satisfactory for daylight working over long distances. The ship's installation departs from normal practice. In the transmitter the high-frequency carrier wave is generated by a crystal-controlled master oscillator, which is operated on a quarter of the radiated frequency in order that a comparatively thick crystal may be used. The output from the master oscillator is passed through a balanced amplifying stage, which entirely prevents the frequency from being affected by subsequent operations in the transmitter. The frequency is then quadrupled by two harmonic generators connected in cascade, and the carrier increased to its final power by two stages of h.f. amplification, each comprising two thermionic valves connected in "push-pull." Modulation is effected on the first of the amplifiers, a modification of the "Teising," or choke-control, method being adopted, which enables the carrier to be completely modulated. The final power amplifier valves are water-cooled, and have an output of 2 kW each. The transmitter energy is obtained from motor-generator sets run from the ship's mains. A spring floor isolates the transmitter from the vibration of the ship.

The super-heterodyne receiver comprises two stages of high-frequency amplification, employing screened-grid valves, followed by a first detector, beating oscillator, five stages of intermediate-frequency amplification, second detector, and one stage of audio-frequency amplification. The intermediate-frequency amplifier has a high degree of selectivity, required for duplex working.

In order to counteract fading, automatic volume control is incorporated; it consists of a special detector valve connected in parallel with the second detector of the receiver, and so arranged that the strength of the received signals varies the grid bias on the first detector. A strong signal increases the bias, and so reduces amplication, which is accomplished by using a separate anode battery for this valve and connecting a resistance between that battery and earth; the potential across that resistance is applied to the first detector. The receiver is assembled on duralumin trays, front panels carrying the motors and controls, the whole being in a teak cabinet. For protection against vibration, rubber cushions are provided on the base, together with shock-absorbing springs for wall mounting.

The transmitter aerial is rigged between the funnel and the main mast, consisting of a horizontal wire slightly less than half the wavelength long, broken in the middle by a tuning coil, across which is connected the high-frequency transmission line used to excite it. This consists of a pair of wires, spaced about 6 in. apart, leading down to the transmitter. Since the size of the aerial depends on the wavelength, separate aerials are used for each wavelength.

Passengers using the service speak into an ordinary subscribers' instrument. The operator has a variable amplifier and visual volume indicator, which enable him to adjust the level of the speech and send it over the lines to the transmitter. He can also adjust the volume of received speech before sending it to the passenger's cabin.

The Telephone Service.—North Wales District.—The annual report prepared for the local Advisory Committee shows that in 1929 in the North Wales, Chester, and Hanley district (superintending engineer: Mr. R. A. Weaver, M.I.E.E.) the number of telephones was 40,081, an increase of 7.8 per cent. New rural exchanges numbered 10 and 8 others will be opened shortly. Two automatic exchanges were inaugurated and another will be commenced this year. A new manual exchange was opened, four were modernised, while the extension of others added 933 subscribers' circuits. Underground circuits were considerably extended during the year; 7,291 miles of wire was brought into use for main and local wires, making a grand total of 131,515 miles of underground wires. Overhead wires for trunk and local services erected during the year amounted to 1,388 miles, bringing the total (with spares) up to 68,277 miles, an increase of 2.37 per cent. The comparative increase of underground wires was 7,291 miles for main and subscribers' lines. The number of kiosks and urban, rural, and railway station call offices was materially augmented. Trunk calls totalled 3,920,430, an increase of 9.02 per cent. Telephoned telegrams decreased by 3.5 per cent. to 304,153. Local and junction calls numbered 17,613,430, an increase of 12.4 per cent.

Radio Notes.

Australia.—FIELD INTENSITY.—A paper recently presented before the Physical Society of London described how Mr. R. O. Cherry, M.Sc., of the University of Melbourne, measured the field intensities round some of the Australian radio-telephone broadcasting stations in order to determine some of the factors controlling the propagation of electromagnetic waves, and the effect of the surface conditions on their attenuation. A simple loop, condenser, and valve voltmeter circuit was employed for the measurement of intensities as small as 1 millivolt per metre. The grid-rectification voltmeter described measured e.m.f.'s down to 0.01 volt, free from frequency error, reasonably stable in calibration, and did not absorb power from the circuit to which it was connected, the last fact being contrary to current theory. The advantages of this intensity set, which agreed over a wide range with a Western Electric set, in respect of simplicity, convenience, and portability, are pointed out.

From field strength contours the following conclusions are drawn: (i) Very rapid attenuation of the signal is caused by Australian forest areas; this curtails enormously the areas for which a satisfactory service is provided. (ii) The effective conductivity of the various types of ground surface met with varies from 4×10^{-13} to 0.07×10^{-13} e.m.u., according to the number of trees in the areas covered. (iii) The use of a longer wave results in a marked increase of intensity at distant points beyond forest areas. (iv) For daylight transmission over sea water up to 85 miles, after the application of curvature corrections to the intensity, Sommerfeld's formula is correct to within the limits of experimental error. (v) The efficiency of radiation of the three aerials examined range from 48 to 60 per cent.

Finally, the limits of signal intensity required for satisfactory reception under Australian conditions are discussed, and it is suggested that atmospherics and other disturbances are less prevalent in Victoria than in Europe or America.

Brookman's Park.—DUAL WAVES.—The experimental transmissions which commenced on December 9th, 1929, will cease on March 9th, when simultaneous dual-programme dual-wave transmission will be inaugurated. The "national" programme will be radiated on a wave-length of 261.3 metres by 2LO and Daventry (5XX, on 1,554.4 metres); also eventually by one of the transmitters at each of the projected dual-wave regional stations. The 2LO "regional" programme will be radiated on a wave-length of 356.3 metres. On the same date the Daventry (5GB, 479.2 metres) station will emerge from its experimental category and be known as the Midlands regional transmitter.

Latvia.—WAVE-LENGTH.—The Riga radio-telephone broadcasting station (3 kW, 572 kc/s, 525 m) has warned listeners that its wave-length is being used by the Russian Soviet station at Smolensk (2 kW, 531 kc/s, 565 m) for the dissemination of, it is alleged, communist speeches against the Latvian Government.

Regional Broadcasting.—SCOTTISH HEADQUARTERS.—Edinburgh will become the headquarters of the Scottish section of the regional scheme when the new high-power station is completed in six months' time. The existing four stations will cease to function, but the Glasgow studios will be retained.

U.S.A.—NEW ANTENNA.—Station KDKA of the Westinghouse Electric and Manufacturing Company will have at its new transmitter near Saxonburg, Pennsylvania, an antenna which is expected to overcome one of the major obstacles to high-power broadcasting. The antenna is said to be so designed that it will not "blanket" the surrounding territory, yet it will send out powerful signals to distant points.

By reversing the action of the antenna it will be possible to send out a strong ground wave and a weak sky wave, which is a condition valuable to the local station. By decreasing the sky wave of the weaker station its "nuisance" area will be reduced, as it will not cause as much interference at a distance. The new antenna is being developed by Dr. Frank Conrad, which uses eight vertical antennæ set in a circle, the position of each pole being established accurately in advance. The effect is that the horizontal signal from each vertical antenna is absorbed, or "blocked off," by the signals from another. Thus only a small amount of signal escapes along the ground and the greatest signal force is upward. The KDKA antenna will be formed by a circle of wooden poles bearing a birdcage aerial 800 feet in diameter with poles 110 ft. in height.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Antwerp.—March 20th. Municipal Council. Signalling and lighting installation for a swing bridge at the Antwerp Docks. (B.X. 6205.)*

Argentina.—BUENOS AIRES.—May 22nd. Department of Sanitary Works. Three electric pumping sets, piping and valves. (A.X. 9212.)*

Australia.—MELBOURNE.—April 14th. State Electricity Commission of Victoria. 22,000-V switchgear and accessories for substation "C" at Brunswick. (B.X. 6182.)*

May 12th. Supply of 22,000-V pin-type supporting insulators, for 12 months. (B.X. 6179.)*

Posts and Telegraph Department. April 1st. Submarine cable. (B.X. 6070.)*

April 15th. Cord-type switchboards. (B.X. 6135.)* Lead-covered switchboard cable. (B.X. 6202.)*

April 29th. Telephone relays. (B.X. 6157.)* P.A.B.X. relay sets. (B.X. 6158.)*

April 22nd. Braided switchboard cable. (B.X. 6201.)*

SYDNEY.—April 28th. Department of Public Works. Electrically-driven high lift and low lift pumping plants, &c. (A.X. 9219.)*

Bedford.—March 10th. Electricity Department. Supplies during the year ending March 31st, 1931, of e.h.p., l.p., and l.p. underground cables, and incandescent electric lamps. (February 14th.)

Belgium.—IXELLES.—March 21st. Municipal authorities. Supply of 845-, 220-, and 440-V d.c. electricity meters. Particulars (Cahier des Charges) for 6¼ fr. from Service de l'Electricité, 20 Rue d'Alsace Lorraine, Ixelles.

Blackburn.—March 10th. Electricity Committee. Supply of paper-insulated lead-sheathed cables, rubber-insulated wire, meters, and gasfilled and vacuum lamps for twelve months ending March 31st, 1931. (February 14th.)

Cardiff.—March 19th (corrected date). Electricity Department. Supply and delivery of e.h.p. and l.p. paper-insulated cables during twelve months commencing April 1st, 1930. (February 28th.)

Colchester.—March 17th. Electricity Department. Supply and delivery of about 11 miles of e.h.p. underground cable and about one mile of l.p. underground cable. (See this issue.)

Congleton.—Corporation. April 1st. H.p. and l.p. switchgear, transformers, kiosks, h.p. and l.p. cables, and l.p. overhead distribution. (See this issue.)

Dublin.—March 12th. Commissioners of Dublin Union. Electrical fittings required during period April 1st to September 30th. Form of tender from Master of Workhouse.

Dundee.—Corporation. Electric lighting installations for 84 houses. Particulars from G. Baxter, director of housing, 91, Commercial Street.

Edinburgh.—March 24th. Corporation. Supply for twelve months from May 16th, 1930, of underground insulated cables, underground conduits, pavement and road box frames and covers, house service fuse boxes and fuseboards, meters, link disconnecting boxes and cable dividing boxes. (February 14th.)

Egypt.—ALEXANDRIA.—March 27th. Ports and Lighthouses Administration. Electric cables. (B.X. 6199.)*

Harrogate.—March 15th. Electricity Department. Supply of general stores for 12 months commencing May 1st, 1930. (February 21st.)

Leek.—March 10th. Cheddleton Mental Hospital. Electric lamps for six months. F. G. Eve, clerk and steward.

London.—CENTRAL ELECTRICITY BOARD.—March 24th. Supply, delivery and erection of 33-kV and lower voltage transformers for the North-West England and North Wales Electricity Scheme. (February 28th.)

March 31st. Supply, delivery and erection of metering equipment required in the area of the North-West England and North Wales Electricity Scheme. (February 28th.)

April 7th. Supply, delivery and erection of 66-kV and lower voltage transformers. (See this issue.)

LONDON COUNTY COUNCIL.—March 24th. Supply and erection in Blackwall tunnel of four electrically-driven exhaust propeller fans and two centrifugal blowing-fan sets. Four steel lattice girders, various steel joists, platforms, &c. (February 28th.)

March 17th. Wiring and fittings for electric lighting in a block of dwellings known as Broxholme House, Harwood Road site, Fulham, consisting of about 425 wiring points. (See this issue.)

Metropolitan Asylums Board.—March 19th. Installations of synchronised electric clocks at Joyce Green Hospital, Dartford, electric sewing machines at Southern Hospital, Dartford, and conversion of workshop power units to electricity at Darenth Training Colony, Dartford. (See this issue.)

Bethnal Green.—Borough Council. March 17th. Supply, delivery and laying of l.p. cables, pipes, &c. (February 28th.)

Liverpool.—March 12th. Electricity Supply Department. Supply of 5,000-kVA, 12,500 kVA, and 33,000-V step-down transformers and 6,000-V and 33,000-V metal-clad switchgear for sub-stations. (February 21st.)

Manchester.—March 21st. Electricity Committee. Six months' supply of electric cooking ranges. (See this issue.)

New Zealand.—Wellington.—April 29th. Public Works Department. One 10,000-kVA synchronous condenser and accessories. (B.X. 6034.)* Single-phase transformers and accessories. (B.X. 6035.)*

May 6th. 750-kVA transformers for Arapuni power scheme. (B.X. 6095.)*

May 13th. 110-kV transformers for Mangahao power scheme. (B.X. 6096.)*

Oldham.—March 10th. Board of Guardians. Electric lamps and fittings. Form of tender from F. W. Fletcher, Clerk to the Guardians, Union Offices.

Prestwich.—March 10th. Urban District Council. Electric lamps required during the year 1930-31. Form of tender, &c., from H. T. Ainsworth, Surveyor to U.D.C., Town Hall.

Rhondda.—March 29th. Electricity Department. Supply of a.c. house service meters, cables, joint boxes, compound, cut-outs, &c. (February 21st.)

South Africa.—Cape Town.—April 2nd. Electricity Department. Five sets of electrically-driven pumps, with accessories, &c. (A.X. 9096.)*

Johannesburg.—March 27th. Municipal Council. Paper insulated, lead covered double steel tape armoured and jute served cable. (B.X. 6200.)*

Stoke-on-Trent.—March 12th. Electrical Engineer's Department. Supply for 12 months of e.h.p. truck type switchgear and a.c. and d.c. meters. (February 21st.)

Torquay.—March 10th.—Electricity Department. Supply, delivery, and erection of one 7,500-kW turbo-alternator and condensing plant. (February 21st.)

Warrington.—March 10th. Electricity Department. Motors and transformers. (February 21st.)

West Ham.—March 27th. Board of Guardians. Electrical work and the laying of main and sub-main cables and wiring of the various blocks at the Central Home, Union Road, Leytonstone. (See this issue.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Australia.—Sydney.—New South Wales Government Railways and Tramways.

6,600-V metal-clad switchgear for Argyle sub-station (£8,386).—A Reyrolle & Co., Ltd.

—*Tenders.*

Municipal Council.

House service fuses and fuse boxes (£1,900).—British General Electric Co., Ltd.

Jointing material for 33,000-V underground and pilot cable (£529).—Siemens (Australia) Pty., Ltd.; (£72), Standard Telephones & Cables (Australia), Ltd.

Barking.—Tramways Committee. Accepted:—

Reconstruction of tram track (£27,515).—W. Griffiths and Co., Ltd.

Cheltenham.—Streets Committee. Accepted:—

Electric lighting fittings for 12 months.—Sharpe & Fisher and Siemens Electric Lamps & Supplies, Ltd.

Dumfries.—Town Council. Accepted:—

Three transformers (£266).—Crompton Parkinson, Ltd.

Eastbourne.—Electricity Committee:—

Assisted wiring at East Dean and Friston:—

	Price per point. £ s. d.
A. E. Perry & Son (accepted)	1 1 0
R. G. Cross	1 4 0
E. J. Robinson	1 7 6
British Universal Illuminations	1 2 6

One ten-cubicle 2,200-volt two-phase switchboard (Ashford Road sub-station), (£1,150); one l.p. board (Ashford Road sub-station) (£280). Transformers: Six 1,000 kVA indoor type oil-cooled (£2,940); four 1,000 kVA outdoor type oil-cooled (£2,160); two 250 kVA outdoor type oil-cooled (£520); two 500 kVA outdoor type oil-cooled (£750); cable connections in accordance with schedule of prices (£500).—General Electric Co., Ltd. (Accepted.)

Dewsbury.—Town Council. Accepted:—

500-kW rotary convertor, with Yorkshire transformer (£1,285).—Harland Engineering Co., Ltd.

1,500-kW motor convertor (£3,200).—Bruce Peebles & Co.

D.c. switchboard (£1,549).—Electric Construction Co.

Battery (£196).—Tudor Accumulator Co., Ltd.

Cable (£2,439).—Power & Lighting Cables, Ltd.

Hull.—Tramways Committee. Accepted:—

Two generator sets (£450).—G. Baigent & Co.

Electricity Committee. Accepted:—

Two vertical spindle drainage pumps and accessories (£728).—Pulsometer Engineering Co., Ltd.

Circulating water pipes (£33,649).—R. G. Tarran.

Telephones Committee. Accepted:—

Insulators.—Equipment & Engineering Co., Ltd.

Bronze wire (£441).—F. Smith & Co.

Lead-in cable (£116).—British Insulated Cables, Ltd.

Ilford.—Electricity Committee. Recommended:—

Battery for Orwell vehicle (£168).—D.P. Battery Co., Ltd.

London.—Metropolitan Asylums Board.

Installation of electric lighting at Woolwich casual ward:—

Alpha Manufacturing & Electrical Co., Ltd. (Recommended)	£175
T. Clarke & Co.	182
A. Hawkins & Sons	185
S. Reed & Sons	189
H. Lewis & Co.	194
C. Rickards, Ltd.	195
Toy & Winslow	195
K. Hedin	197
Read & Partners, Ltd.	198
Phillips & Sons (Chiswick), Ltd.	218
Piggott Bros. & Co., Ltd.	220
H. L. Halstead & Co.	226
General Installation Co., Ltd.	284

Installation of electric lighting at Lambeth casual ward:—

Alpha Manufacturing & Electrical Co., Ltd. (Recommended)	£162
H. Lewis & Co.	163
T. Clarke & Co., Ltd.	173
A. Hawkins & Sons	175
Phillips & Sons (Chiswick), Ltd.	193
K. Hedin	206
Toy & Winslow	213
Telephone & Electrical Maintenance Co. ...	216
Read & Partners, Ltd.	218
S. Reed & Sons	220
Rickards, Ltd.	232
Piggott Bros. & Co., Ltd.	242
General Installation Co.	340

Central Electricity Board.

Six 30,000-kVA 3-phase transformers for the Mid-East England Electricity Scheme.—General Electric Co., Ltd.

Poplar.—Electricity Committee. Recommended:—

Cooling pond (£5,498); cooling tower (£4,402).—Davenport Engineering Co., Ltd.

Kensington.—Works Committee. Recommended:—

Electrical fittings for 12 months.—Bate Electrical Co., Ltd.

London Midland & Scottish Railway Co.

12 months' supply of electric lamps.—Edison Swan Electric Co., Ltd.

Admiralty.

Electric lamps.—Siemens Electric Lamps & Supplies, Ltd.

Maidenhead.—The Town Council has accepted the following tenders:—

Rectifier plant for sub-station (£1,295).—Hewittic Electric Co., Ltd.

Four transformer kiosks (£885).—W. Lucy & Co., Ltd.

Sub-station switchgear (£268).—Drake & Gorham Wholesale, Ltd.

Manchester.—Transport Committee. Accepted:—

Constant potential battery charging equipment.—Crypto Electrical Co., Ltd.

Cyclone h.p. vehicle washing plant.—Equipment & Engineering Co., Ltd.

Electricity Committee. Accepted:—

Water tube boiler and accessories.—John Thompson Water-tube Boilers, Ltd.

Air heater.—Howden-Ljüngstrom Preheaters, Ltd.

Fans.—Davidson & Co., Ltd.

Grit arrestor.—Pneumatic Conveyance & Extraction, Ltd.

Mechanical stokers.—Underfeed Stoker Co., Ltd.

Motors.—Lancashire Dynamo & Motor Co., Ltd.

Starters.—Brookhirst Switchgear, Ltd.

Soot removal plant.—British Vacuum Cleaner & Engineering Co., Ltd.

Coal weighers.—W. & T. Avery, Ltd.

Fittings.—Hopkinsons, Ltd.

Transformer neutral earthing resistance and switchgear for sub-station.—Ferguson, Pailin, Ltd.

Outdoor type sub-station kiosk.—English Electric Co., Ltd.

Reading.—Board of Guardians. Accepted:—
Lighting of new casual wards at Woodley (£425).—J. H. Winter & Co.

Salford.—Electricity Committee. Recommended:—
Cables for 12 months.—(£2,072), Derby Cables, Ltd.; £9,328), N. V. Nederlandsche Kabelfabriek.

Sheffield.—Tramways Committee. Recommended:—
18 pairs tramcar traction motors (£6,390).—Metropolitan-Vickers Electrical Co., Ltd.
18 car sets of control and braking system (£3,735).—Maley and Taunton, Ltd.
18 tramcar trucks (£3,744).—Cravens Railway Carriage and Wagon Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
500 meters in connection with the change from d.c. to a.c. —Chamberlain & Hookham, Ltd.

Stoke-on-Trent.—Electricity Committee. Accepted:—
15-cwt. electric mains van (£404).—General Vehicle Co., Ltd.
Static transformers for 12 months.—Metropolitan-Vickers Electrical Co., Ltd.
Mains and cables for 12 months.—Callender's Cable & Construction Co., Ltd.
Repairing storage battery (£229).—D.P. Battery Co., Ltd.

Stoke-on-Trent and Wolstanton.—Board of Guardians. Laying cables for the new Nurses' Home (£2,537).—Barnett & Soans. (Accepted.)

York.—Electricity Committee. Recommended:—
Switchgear (£6,695).—A Reyrolle & Co., Ltd.

Forthcoming Events.

Junior Institution of Engineers.—Friday, March 7th. 39, Victoria Street, S.W. 7.30 p.m. "Chile and Engineering in Chile." Lt.-Col. G. J. Hartley, R.E.

Royal Institution of Great Britain.—Saturdays, March 8th and 15th. 21, Albemarle Street, W.1. 3 p.m. "Atomic Nuclei and their Structure." Sir E. Rutherford.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, March 11th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Condensing Plant and Accessories."

Saturday, March 8th. Café Royal, Regent Street, W. 7 p.m. Annual dinner and dance.

Edinburgh Electrical Society.—Wednesday, March 12th. 16, Royal Terrace, Edinburgh. Annual general meeting.

Institute of Metals.—Wednesday, March 12th. Hotel Metropole. 6.45 for 7 p.m. Annual dinner and dance.

Institution of Electrical Engineers.—Thursday, March 13th. Savoy Place, W.C.2. 6 p.m. "The Imperial Chemical Industries Steam and Electric Power Plant at Billingham." Messrs. H. A. Humphrey, D. M. Buist, and J. W. Bansall.

(North-Eastern Centre).—Monday, March 10th. Armstrong College, Newcastle-upon-Tyne. 7 p.m. Ordinary Meeting.

(North-Midland Centre).—Tuesday, March 11th. Hotel Metropole, Leeds. 7 p.m. Annual Dinner.

(Scottish Centre).—Tuesday, March 11th. Freemasons' Hall, Edinburgh. 8 p.m. Faraday Lecture, "Broadcasting by Electric Waves." Capt. P. P. Eckersley.

(Western Centre).—Monday, March 10th. Bristol. 6 p.m. "The Breaking Performance of H.P. Switchgear and of a new form of Quenched Arc Switch." Mr. L. Grant.

(Dundee Sub-Centre).—Thursday, March 13th. University College. 7.30 p.m. Ordinary meeting.

(Scottish Students' Section).—Wednesday, March 12th. Royal Technical College, Glasgow. 7.30 p.m. Annual general meeting.

(North-Western Students' Section).—Tuesday, March 11th. Engineers' Club, Manchester. 7.15 p.m. "Electrical Insulating Material." Lt.-Col. K. G. Maxwell.

(North-Eastern Students' Section).—Friday, March 7th. Armstrong College, Newcastle-on-Tyne. 7.15 p.m. "Power Transformers." Mr. I. H. Hedley.

Scottish Students' Section.—Tuesday, March 18th. Heriot Watt College, Edinburgh. 7.15 p.m. Mr. L. B. Torond. "Transformer Cooling Problems."

South Midland Students' Section.—Tuesday, March 11th. The University, Birmingham. 7.30 p.m. "Overhead Line Work." Mr. F. J. Baldwin.

Birmingham Electric Club.—Friday, March 14th. Grand Hotel. 7 p.m. Annual dinner.

Physical Society.—Friday, March 14th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Notes.

Neon Tubes for Television.

Neon tubes are indispensable to television experimenters, as they are the media by means of which are made visible the light intensities which are transmitted in the form of electrical impulses. It is therefore necessary that a good lamp be used; that is, one that will respond immediately to the minute current inflections. A lamp made by Philips Lamps, Ltd., has characteristics which are suitable for television work. Fitted with a three-pin base, one pin of which is a steadying device to ensure the lamp being inserted in its correct position, the overall dimensions of the lamp are approximately 6¼ in. by 2 in.

The cathode measures approximately 1¼ in. by 1¼ in. and has an insulating backing, thus restricting the luminescence to one side only. On test the lamp proved to have very little inertia, for its response to current variations was instantaneous, or practically so. As the operation of the lamp depends upon varying light intensities on the plate caused by a varying current, it is important that the plate should always be luminescent. It is, therefore, necessary for a current of at least 4 mA to be used, which represents a reduction of some 2 mA. There are various methods of coupling the neon lamp to the last stage of the amplifier.

Submerged Combustion.

Mr. C. Featherstone Hammond recently read a paper before the Institute of Fuel in London on the above-named subject, which, as the name implies, is a method of heating by direct contact of the flame from a burner which projects the white-hot gases directly into, and at any depth below the surface of, a fluid, such as water, oil, tar, or substances which are solid at normal temperature, but which may be rendered liquid by the application of heat, such as paraffin wax, pitch, lead, tin, zinc, and other white metals. For such a method to be successful it is necessary to speed up the chemical combination of the fuel with the necessary air for combustion, so that it takes place too fast for any quenching action to become effective. In the Hammond system a supply of fuel and the whole of the necessary air in the chemically correct proportions are introduced into a mixing appliance wherein they form a homogeneous mixture of uniform composition.

Internal Trade and the Metric System.

Writing in *Measurement*, Mr. Harry Allcock, states that the manufacturers and traders in non-metric countries are already compelled to employ the metric system in an ever-increasing portion of their business, so that they now find themselves confronted with the alternatives of either wasting more and more time on conversions from and to the metric system, or of demanding that all their commercial contracts shall be expressed solely in metric terms. To continue their present practice involves the use of two systems instead of one, and they can no longer avoid the use of the metric system by reason of its adoption in so many countries whose trade they seek. Mr. Allcock goes on to show that the adoption of the metric system by manufacturers in all their commercial contracts would not involve the scrapping of existing workshop tools, patterns and other manufacturing standards.

Appointments Vacant.

Two assistant engineers in the Chief Engineer's Department of the L.C.C. District mains engineer for Hackney Borough Council Electricity Department. Deputy distribution engineer for Croydon Electricity Department. General manager and chief engineer (£500) for the Cannock Urban District Council electricity undertaking. (See our advertisement pages to-day.)

Electric Coaling Plant.

At the London and North-Eastern Railway's locomotive depôt at Coatbridge electrically-operated mechanical coaling plant has been put into commission. The coal from the overhead storage hoppers is delivered to the engines by means of an electrically-operated endless steel belt, and the amount of coal delivered to each engine is automatically registered on a tape, together with the engine's number. Coal is delivered by this means from the overhead hoppers at the rate of 1.5 tons per minute. The plant was constructed to the specification of the chief mechanical engineer of the London and North-Eastern Railway by Messrs. Henry Lees & Co., of Glasgow.

Electrical Firedamp Detectors.

Following a demonstration in the House of Commons in December of apparatus for the automatic detection of firedamp in mines, the miners' group of Members of Parliament appointed a deputation which discussed in January with the Secretary for Mines the general problem of guarding in mines against the dangers of inflammable and noxious gases.

After a full and frank discussion of the whole problem, he informed the deputation that, in his view and that of his advisers, electrical firedamp detectors, in their practical application to the daily work of mines, were still in a stage of experiment and development, and that he would not yet be justified in requiring, or even recommending, their general or extensive use. He promised to consider suggestions made by the deputation with a view to the further development of such detectors, and a further meeting is to be arranged later.

Use of Electricity at Mines.

H.M. Secretary for Mines draws attention to a new edition of the handbook of Explanatory Notes by H.M. Electrical Inspector of Mines on the general regulations governing the installation and use of electricity at mines under the Coal Mines Act, 1911. This handbook is intended to serve as a practical guide to mine managers, electricians, mechanics, and others in carrying out their duties under the regulations, in the choice of safe and suitable plant, in its safe installation and efficient maintenance, and generally in the observance of those precautions which experience has shown to be necessary for the prevention of accidents. A good many suggestions on developments in practice since the previous addition have been added, including: the necessity for prompt automatic isolation of a faulty circuit, preferably by "leakage protection," to make "earthing" an effective safeguard against electric shock, and as an additional precaution against open sparking in cables; the application of "remote control" to coal-cutting machines, and other coal-face machinery, as a means (in particular) of reducing the risk of open sparking at the machine by removing the troublesome starting switch from the machine; the frequency with which certain tests and detail examinations, covering all parts of the electrical installation, should be made by the electrician, in order to anticipate serious defects and so avoid possible danger; the provision of permanent and safe means for earthing the conductors of a circuit, especially upon high-voltage systems, before men are set to work upon them; the utility of "pliable armoured cable" for the service of conveyors and similar semi-portable machinery. The new edition, "Mines and Quarries Form No. 11, January, 1930," can be purchased, price 6d., from H.M. Stationery Office.

Association of Supervising Electrical Engineers.

The report of the annual dinner of the Association given on pp. 400-401 of our last issue contained a typographical error in stating the value of contracts placed by the Central Electricity Board. The amount should have been printed as "well over £10,000,000."

Agreements for Interchange of Energy.

In the Electrical Review of February 14th reference was made in the article entitled "Real Rural Development" to interconnections for reciprocal stand-by supplies between the Shropshire, Worcestershire and Staffordshire Electric Power Co. and neighbouring undertakings.

These arrangements have resulted in considerable savings in capital expenditure, as they make unnecessary duplication of lines in the more extreme portions of the high-voltage distribution system until the load has developed.

By the courtesy of Mr. J. T. H. Legge, M.I.E.E., managing director of the Shropshire, Worcestershire and Staffordshire Electric Power Company, we are permitted to publish the general conditions of these interchange agreements.

(1) Interconnecting mains are laid to connect the nearest suitable points of the high-pressure distribution systems of the undertakings. (2) Jointly-owned control gear is installed at a convenient sub-station. (3) Either undertaker may call on the other for assistance in emergency, provided that the latter has spare plant available. (4) The terms are based on the maximum demand and the number of kWh taken during the working week, *i.e.*, from 6 a.m. on Monday morning until 1 p.m. on the following Saturday. (5) The maximum demand prices vary according to the length of the demand. For demands continuing for three days or less the price per kW is lower than for demands extending over the working week. In the case of supplies taken over the week-end, the running cost only is charged.

Electricity in Kinemas.

A meeting of the members of the Paisley Association of Electrical Engineers was held recently with Mr. James Orr, president, in the chair, when Mr. Wm. M'Gregor, of Messrs. Chalmers, Ltd., delivered a most interesting lecture on electrical engineering as applied to kinemas. He quoted the Cinematograph Act and held that the regulations, if properly complied with by all proprietors, were sufficient for the safety of the public. The lecturer discoursed on how kinema theatres should be equipped electrically, and dealt with the projection of films, lighting the auditorium, limelight effects, general lighting, heating by the tubular system, ventilation, and the cleaning of upholstery by vacuum cleaners. Control room, "talkie" apparatus, and generating plant were explained. A plan of the wiring and general lay-out of a first-class kinema theatre was exhibited also, and Mr. M'Gregor quoted costs in detail of a complete electrical equipment.

Cable Jointing.

A recent publication of Messrs. W. T. Henley's Telegraph Works Co., Ltd., "Notes for Jointer for e.h.t. Joints," should prove useful to all engaged in the distribution of electricity—both engineer and jointer. It introduces "the modern method" of jointing e.h.p. paper-insulated cables, and 28 progressive stages in the making of a joint are fully described and illustrated. The publication is made up in folder form in a convenient size for the pocket.

The Electrical Association for Women.

The first ordinary meeting of the Bradford branch of the Electrical Association for Women, held at the Bradford Corporation Electricity Offices recently, was addressed by Mr. Harry Moss, hon. secretary of the Bradford E.D.A. Circle, who reviewed along general lines the need for extending the education of householders in things electrical. He urged a "safety first" policy for householders by means of a better elementary knowledge of their electrical installations.

A branch has been formed at Torquay of the Association, with Mrs. V. F. Gresham as president and Miss Binney as honorary secretary. Sixty-six members have already been enrolled. The Electricity Committee of the Torquay Corporation has sent a cheque to the new branch.

The 1930 annual conference of the E.A.W. will be held in London on May 15th and 16th. Preliminary arrangements include a luncheon on May 15th at the Park Lane Hotel, over which the president, Mrs. Wilfrid Ashley, will preside, and at which the Minister of Transport will be the principal speaker. A ball will be held at the Park Lane Hotel on May 16th.

At the invitation of the city electrical engineer, Mr. E. G. Okell, 40 members of the Pymouth branch of the Association visited the Plymouth Corporation's power station at Prince Rock on January 29th.

On February 1st the East Devon branch of the Association arranged a lecture and demonstration on "Electric Housewifery" for the local branch of the Association of Domestic Science Teachers, and by kind permission of the Exeter Corporation the demonstration was held at the Electricity Department showroom, where a full range of domestic apparatus was shown and demonstrated.

The members of the Hartlepools branch of the Association recently made a presentation to their secretary, Mrs. J. H. Parker, who is leaving the district, in the form of a cut-glass electric lamp.

A very interesting lecture, "A Tabloid Talk on Tariffs," was given by Mr. L. L. Robinson, engineer and manager, Hackney, before the E.A.W. on February 28th. Mr. Robinson explained the difficulties which engineers had to encounter in fixing tariffs, and also the various kinds of tariffs in existence. A good discussion followed, in which the consumers' point of view was put forward. On the whole the two-part tariff seemed to be the most popular, the general conclusion being that all tariffs should be of a very simple nature, and such that the consumers could easily understand. A very popular scheme on the Continent was mentioned by Mr. E. E. Sharp, namely, the two-rate tariff by which the units used during certain hours of the day were charged at a very high lighting rate, and the remainder were charged at a very low rate, round about ½d. per unit.

Gas Light and Coke Company.

At the general meeting of the proprietors of the Gas Light and Coke Company Sir David Milne-Watson, LL.D., D.L., said that the year under review had been a record one, a greater quantity of gas having been sold than in any previous year, largely due to the prolonged spell of cold weather at the beginning of 1929.

There had been an increase in sales over the previous year of 4¼ per cent., representing over 2,000 million cu. ft., and the record day's output was on February 15th (over 240 million cu. ft.).

Coal and oil cost more, owing to the increased quantities required for the extra make of gas. With an increase of 4¼ per cent. in the business, the gross cost of manufacture was only just over 1 per cent. more than the previous year.

The only weak spot in revenue account was to be found in residuals. Although coke gave an increased revenue, the other products fell away.

In regard to the Holborn explosion it was agreed that the company and the Post Office should each bear half the cost of compensation to third parties. Already a very large number of claims had been settled, the cost of which was included in a sum of £35,000 drawn out of the special purposes fund.

The question causing the most anxiety at the present moment was the Government Coal Mines Bill. The gas industry was largely, indeed almost entirely, dependent upon coal for the manufacture of gas. Oil in considerable quantities was purchased for carburetting water gas, but in the year 1928 carburetted water gas only amounted to 15 per cent. of the total gas manufactured in this country.

The accusation had been levelled against the industry that it was paying an unfair price for its coal, but gas coal, like any other, was bought in the open market. The decision to shorten the miners' hours of work had forced the Government to placate the coal-owners by enabling the latter to obtain higher prices. To achieve this result the Government was, in effect, forcing the coal industry to convert itself into a monopolistic trust, and had so framed the measure that no effective control over the owners as a real safeguard for the consumer could be devised. It had been said that the gas industry was itself really a trust, but the gas industry was strictly limited as to the dividends it could distribute, as an increase in the price of gas must be accompanied by a decrease in the dividend.

This trustification would adversely affect all coal consumers in this country, but the gas industry most of all. The spokes-

men, both of the Government and of the coal industry, had unequivocally stated that the gas industry must pay more for its coal. Part I of the Bill enabled the coal-owners to levy taxation upon any section of the community, not merely for the purpose of recouping the coal industry for the increased costs of production due to shortened hours, but also for subsidising the export of coal. Moreover, the coal-owners could weight the scales in favour of their own fuels (household coal and coke-oven coke) as against the fuels produced by the gas industry (gas and gasworks coke).

There were 36 million people using gas in this country, and the industry directly employed 113,000 persons. Every effort should be made to ensure the rejection *in toto* of Part I of the Bill.

O.L.A. Supper-Dance.

One of the most enjoyable of this season's social functions was the Overhead Lines Association's conversazione and supper-dance in the spacious Georgian Restaurant of Messrs. Harrods, Knightsbridge, London, on Wednesday evening, February 26th. Nearly 200 members and guests with their ladies were received by the President, Mr. Theodore Stevens, and Miss Stevens. Dancing was indulged in until midnight to well-selected music provided by a string orchestra of ladies; Mr. J. H. C. Brooking carried out the duties of M.C. At 10 p.m. an excellent four-course supper was served and a selection of overhead-line apparatus and appliances was displayed by the Central Electricity Board, Estler Bros., Edison Swan Electric Co., Electrical Equipment & Carbon Co., Electric Transmission, Concrete Finials, Johnson & Phillips, B.I. Cables Co., Crompton Parkinson, British Aluminium Co., Croydon Cable Co., Standard Switchgear Co., Venner Time Switches, Griffiths Bros., Pirelli-General Cable Co., Mr. F. J. Down, and Major T. Rich. The Electrical Association for Women was also represented. The Social Committee is to be congratulated on the thorough success of the function.

Faraday House Old Students' Association.

The annual supper-dance of this Association and the Faraday House Rugby Club was held on February 26th at the Hotel Russell, Russell Square, W.C. The event, which each year increases in popularity, was attended by over 200 members and friends. A popular feature during the evening was the revival of many old dance tunes and dances, such as the polka, barn dance, &c., which were entered into by the older members of the company who were familiar with them, and by the younger generation, which was not so familiar, but which obviously considered them great fun. "Rad" Smith and his band provided the music. An enjoyable function was concluded in the early hours of the morning.

Institution of Electrical Engineers.

Informal Meeting.—The subject discussed on February 17th was "Batteries and their Uses." Messrs. W. E. Warrilow and M. E. Fox spoke on the alkaline or nickel-iron battery, and Mr. E. C. McKinnon on the lead-acid type. There was a large attendance, and Mr. E. S. Ritter presided. Lantern slides of both the alkaline and the lead-plate batteries in various situations were shown, and there was also an exhibit of different makes of nickel-iron accumulators and their parts. Mr. W. E. Warrilow concluded by emphasising the need for the revival of the commercial electric vehicle using a standard voltage equipment, the adoption of which would do away with confusion in the minds of vehicle buyers.

Mr. M. E. Fox said that the nickel-iron battery of to-day could have an efficiency of 15 watt-hours per pound of complete cell.

Mr. E. C. McKinnon said lead-acid batteries were, in some few applications, in competition with alkaline batteries but, broadly speaking, there was no application of alkaline batteries which was not equally or better served by lead batteries. It might be accepted as an axiom that no one type of battery was suitable for all applications. At least five factors dictated design and type: nature of duty, first cost, space, weight, and durability. So far as lead-acid batteries were concerned, there was a wealth of choice; one firm alone listed and manufactured more than 500 sizes, covering 10 distinct types.

Central Electricity Board.

According to the *Financial Times*, application has been made to the Electricity Commissioners by the Central Electricity Board for a special order for the purpose of authorising an increase in its borrowing powers under Section 27 of the Electricity (Supply) Act, 1926.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. E. P. Barfield and Mr. J. P. Coleman, of Wild-Barfield Electric Furnaces, Ltd., have left England for an extended visit to the United States.

Mr. A. C. Warman, charge engineer in the Halifax Corporation Electricity Department, and late of the British Thomson-Houston Co., Ltd., has been appointed assistant plant and electrical engineer to the St. Anne's Board Mill Co., Ltd., Bristol, as from April 1st.

Mr. S. D. Schofield, who for a number of years has represented Holophane, Ltd., in Lancashire, &c., is leaving the company owing to ill-health. His duties will be taken over by Mr. L. D. Schofield, of Altrincham, Cheshire. After a holiday to recuperate, Mr. S. D. Schofield hopes to take up another appointment.

Mr. G. B. Pierpoint, of Scarborough, who had been recommended for the post of superintendent of the Chester Corporation electrical showrooms, having declined the appointment, the Electricity Committee has offered the position to Mr. H. Mason Lloyd, of Holywell, at a salary of £300 rising by annual increments of £25 to £400.

The marriage took place at St. Michael's Church, Sittingbourne, on February 26th, of Mr. J. G. Clemetson, manager of the Malayan branch in Kuala Lumpur, Federated Malay States, of the General Electric Co., Ltd., and Miss E. Ward, of Sittingbourne.

Mr. G. W. Spencer Hawes, managing director of the Reading Electric Supply Co., Ltd., has been elected to fill a casual vacancy on the Reading Town Council.

Mr. B. H. Collins, installation assistant with the Liverpool Corporation Electricity Supply Department, on February 28th, was presented by his colleagues with an all-electric mains radio receiver to mark his retirement after 48 years' service, first with the Liverpool Electric Supply Co., Ltd., and subsequently with the Corporation.

Ilford Corporation Electricity Committee recommends that the salary of the deputy borough electrical engineer (Mr. G. F. Gregory) be increased by £50 per annum (present salary £700 per annum), and that the salary of Mr. H. King, assistant commercial manager, be increased from £500 to £525 per annum, rising by three annual increments of £25 to £600 per annum.

The Basingstoke Town Council has increased the salary of the borough electrical engineer from £600 to £650 per annum as from April 1st next, rising by annual increments of £25 to a maximum of £800.

Mr. A. Dean, who has been manager of the Yeovil Electric Light and Power Co. since its formation seven years ago, has been appointed manager of the Isle of Wight Electric Light and Power Co., Ltd.

The following appointments have been made by the Westinghouse Brake & Saxby Signal Co., Ltd.: Mr. H. G. Brown, managing director, to be deputy chairman; Capt. B. H. Peter, general manager, to be managing director; Mr. W. H. Powell, general business manager, to be general manager; and Mr. J. Griffith Hall to be secretary in place of the late Mr. R. Payne.

A Bill for the institution of a Hydro-Electric Commission for Tasmania has been passed by the Tasmanian Parliament. The first Chief Commissioner will be Mr. H. A. Curtis, the present chief engineer and general manager of the Hydro-Electric Department. His appointment will be for a term of five years at a maximum salary of £2,000 per annum.

Mr. R. Borlase Matthews has been elected chairman of the Rural Reconstruction Association for the forthcoming year. He has for some time been a member of the Council and chairman of the executive committee, and he has been responsible for the rural electrification policy of this Association.

Mr. A. N. D. Kerr, formerly of the London office of the A.E.G., is taking up an appointment with Messrs. Crompton Parkinson, Ltd.

Mr. Walter Charles Lambourn, A.M.I.E.E., who has been with the Newcastle-upon-Tyne Electric Supply Co., Ltd., for 26 years, has been appointed sectional assistant mains engineer by the Manchester Corporation. He will commence his new duties on March 24th.

Obituary.—Sir Alexander Gracie.—The death occurred on Sunday last, at the age of 69, of Sir Alexander Gracie, K.B.E., M.V.O., an eminent engineer and shipbuilder. He was an adviser to the Admiralty in a number of directions and sat on the boards of several companies, including the English Electric Co., Ltd., and Cammell, Laird & Co., Ltd.

Mr. W. J. Williams.—We learn with regret of the death of Mr. W. J. Williams, mains and works superintendent to the Electricity and Tramways Department of the Aberdare U.D.C., which occurred on February 27th, after a short illness. Mr. Williams had been engaged in the department since its inception.

Mr. H. W. Brookman.—*The Times* reports that Mr. Henry William Brookman, formerly Superintendent of the Central Telegraph Office, St. Martin's-le-Grand, died on February 25th at the age of 91. Mr. Brookman was born in 1839, and he entered the service of the Magnetic Company as an operator after the Great Exhibition of 1851; he was transferred to the Government service in 1870, when the undertaking was purchased by the State. Mr. Brookman rose through all the various grades to the rank of Superintendent in 1895, and retired in 1902.

Mr. H. L. Thomson.—We regret to learn that Mr. H. L. Thomson, chief electrical engineer and manager to the Cannock Urban District Council, was killed in a motor-car collision on Saturday last. Mr. Thomson, who left Wolverhampton eight years ago to take up the position at Cannock, was only 35 years of age. He was formerly with Ferranti, Ltd.

Major J. C. G. McFerran.—The death is announced (in London) of Major John Cecil Grant McFerran, D.L., J.P., of Rickerscote House, Stafford (electrical engineer), formerly in partnership with Mr. W. O. Rooper under the style of Rooper and Co., Stafford. Subsequently he was associated with several rubber companies.

Lord Kintore.—The death occurred in London on Monday last of the Earl of Kintore, who was chairman of Cryselco, Ltd., Duram, Ltd., Durelco, Ltd., and other companies.

Wills.—The late Lieut.-Col. Montagu Cradock, a director of the Metropolitan-Vickers Electrical Co., Ltd., and the Westinghouse Brake & Saxby Signal Co., Ltd., left estate valued at £63,335 (£24,623 net personalty).

The late Mr. Charles Albert Blascheck, M.I.E.E., city electrical engineer of Canterbury for 27 years, left estate valued at £5,667, with net personalty of £5,476.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Beaconectric, Ltd.—Private company. Registered February 26th. Capital £5,000 in £1 shares. Objects: To acquire the business of electrical engineers and factors now carried on by C. Field, H. E. Field, J. A. Miles, and W. J. Miles at 158, Stonhouse Street, High Street, Clapham, as "The Beacon Electrical Co." The directors are: C. Field, "Cranleigh," Covers Road, Claygate, Surrey; H. E. Field, (chairman and managing director), "Cranleigh," Covers Road, Claygate, Surrey; J. A. Miles, "Mayville," Reculver Avenue, Birchington, Kent; W. J. Miles, 2, Nimrod Road, Streatham, S.W. 16. Secretary: W. J. Miles.

Edward Prior Electric Co., Ltd.—Private company. Registered February 25th. Capital £3,000 in £1 shares. Objects: To acquire the business of an electrical engineer carried on by Mrs. L. Prior at 30, Church Road, Burgess Hill, Sussex. The directors are Mrs. L. Prior and A. R. Hunt (director, Burgess Hill Electric Supply Co., Ltd.), 30, Church Road, Burgess Hill, Sussex. Secretary: O. Gravett. Registered office: 30, Church Road, Burgess Hill, Sussex.

R. King & Sons, Ltd.—Private company. Registered February 27th. Capital, £5,000 in £1 shares. Objects: To acquire the business of electrical and mechanical engineers and machinery merchants now carried on at 5a, Speedwell Street, Oxford, by R. King, W. G. King, H. A. King and W. E. King as "R. King & Sons." The directors are: R. King, H. A. King, and W. E. King, all of 5a, Speedwell Street, Oxford, and W. G. King, Pear Tree Hill, Woodstock Road, Oxford. Secretary: A. Saxon. Registered office: 5a, Speedwell Street, Oxford.

Electro Insulators, Ltd.—Private company. Registered February 24th. Capital £1,000 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in all kinds of electrical insulating materials and goods, electrical instruments, tools and all kinds of supplies and goods for electrical engineers, &c. The directors are: W. Korten, address not stated; S. K. Shirt, 9, Broomgrove Crescent, Sheffield.

Voltex, Ltd.—Private company. Registered February 22nd. Capital £100 in £1 shares. Objects: To carry on business as manufacturing, constructional, consulting, electrical, &c., engineers, and that of an electric lighting and power company in all its branches. The first directors are: S. Goodstein and Sadie Goodstein, 24, Parkside, Watford Way, Hendon, N.W.4. Registered office: 6, Noel Street, Oxford Street, W.1.

Tolworth Electricity Co., Ltd.—Private company. Registered February 22nd. Capital £1,000 in £1 shares. Objects: To carry on any operations in relation to marketing electric lighting, cooking, heating, power, and all other kinds of electrical fittings and equipment, &c. The subscribers (each with one share) are: T. B. Lane and V. L. Williams, accountants. Secretary: T. B. Lane, 17, Ambleside Gardens, Ilford.

Powell-Rays, Ltd.—Private company. Registered February 21st. Capital £500 in £1 shares. Objects: To carry on the business of producers and sellers of loud-speakers, wireless sets and instruments, gramophones, &c. The directors are: G. D. Powell, 36, Norfolk Square, W.; A. W. Smith, A.R.C.S., B.Sc., 10, Ashgrove Road, Bromley, Kent. Secretary, G. D. Powell. Registered office: 54, Ashgrove Road, Bromley, Kent.

Official Returns of Electrical Companies.

Maybrook Electrical Co., Ltd.—Capital, £5,000 in 1,000 preference and 4,000 ordinary shares of £1 each. Return dated January 13th, 1930. 100 preference and 2,000 ordinary shares taken up. £2,100 paid. Mortgages and charges, £3,000.

Light-o'-day Electric Lamp Co. (1927), Ltd.—Capital, £10,000 in 7,000 preference shares of £1 each and 60,000 ordinary shares of 1s. each. Return dated December 9th, 1929. 1,300 preference and 60,000 ordinary shares taken up. £1,300 paid on the preference shares. £3,000 considered as paid on the ordinary shares. Mortgages and charges, nil.

Crompton Parkinson, Ltd.—Capital, £676,769 in 200,000 first preference and 326,769 second preference shares of £1 and 600,000 ordinary shares of 5s. each. Return dated October 3rd, 1929. 170,725 first preference, 326,769 second preference and 400,000 ordinary shares taken up. £307,753 2s. 8d. paid (being £1 per share on 6,965 first preference and 250,007 second preference and 7s. 6d. per share on 133,760 first preference shares, plus £621 2s. 8d. paid on forfeited shares). £290,362 considered as paid (being 12s. 6d. per share on 133,760 first preference, £1 per share on 30,000 first preference and 76,762 second preference and 5s. per share on 400,000 ordinary). Mortgages and charges, nil.

Strange & Sons Electrical Engineering Co., Ltd.—Capital, £200 in £1 shares. Return dated December 13th, 1929. 98 shares taken up and fully paid (plus £9 per share premium). Mortgages and charges, nil.

Mersey Cable Works, Ltd.—Capital, £40,000 in 10,000 preference and 30,000 ordinary shares of £1 each. Return dated December 13th, 1929. 19,901 ordinary shares taken up. £19,901 paid. Mortgages and charges, £12,500.

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 3,000 preference and 7,000 ordinary shares of £1 each. Return dated December 3rd, 1929. 2,300 preference and 4,200 ordinary shares taken up. £4,488 paid. £2,012 considered as paid. Mortgages and charges: Floating charge stamped to cover £4,000.

Langham Radio, Ltd.—Satisfaction in full on February 13th, 1930, of debenture dated November 14th, and registered November 27th, 1929. (According to the "Register of Mortgages" the debenture registered November 27th, 1929, originally secured all moneys, &c.)

J. V. Brittain & Co., Ltd.—Satisfaction in full on November 4th, 1929, of debenture dated October 13th, 1927, and registered October 18th, 1927.

Radio Finance Co., Ltd.—Debenture dated February 5th, 1930, to secure sums not exceeding £500, charged on the company's undertaking and property, including uncalled capital. Holder: May E. Brenchley, 36, Netherhall Road, Doncaster.

Credenda Conduits Co., Ltd.—Capital, £50,000 in £1 shares. Return dated November 12th, 1929. All shares taken up. £30,000 paid. £20,000 considered as paid. Mortgages and charges, nil.

Mawdsley's, Ltd.—Capital, £20,000 in 13s. 4d. shares. Return dated November 11th, 1929. 26,525 shares taken up. £9,683 6s. 8d. paid on 14,525 shares. £8,000 considered as paid on 12,000 shares. Mortgages and charges, £11,715 15s. 9d. (secured by debt to bankers).

Castle Fuse & Engineering Co., Ltd.—Mortgage and charge on freehold hereditaments in Liverpool and the company's undertaking and property, present and future, including uncalled capital, dated February 12th, 1930, to secure all moneys due or to become due from the company to the Midland Bank, Ltd.

Kinetic Elutriators, Ltd.—Capital, £5,500 in 5,000 preference shares of £1 each, and 10,000 ordinary shares of 1s. each. Return dated October 2nd, 1929. 4,100 preference and 10,000 ordinary shares taken up. £4,200 paid on 4,100 preference and 2,000 ordinary shares. £400 considered as paid on 8,000 ordinary shares. Mortgages and charges, nil. A return of allotments made up to November 29th, 1929, showed a further 200 preference shares allotted, payable in cash and fully called up.

S. Barnett & Co., Ltd.—Capital, £2,000 in 1,000 preference and 1,000 ordinary shares of £1 each. Return dated November 12th, 1929. 807 preference and 950 ordinary shares taken up. £1,007 paid on 807 preference and 200 ordinary shares. £750 considered as paid on 750 ordinary shares. Mortgages and charges, nil.

Siemens-Schuckert (Great Britain), Ltd.—Capital, £10,000 in £1 shares. Return dated January 3rd, 1930. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Rective Electrical Co., Ltd.—Capital, £10,000 in 116 6 per cent. and 80 7 per cent. preference shares of £50, and 4,000 ordinary shares of 1s each. Return dated January 7th, 1930. 106 6 per cent. preference, 62 7 per cent. preference and 4,000 ordinary shares taken up. £8,600 paid. Mortgages and charges, nil.

Magna Wire & Cable Co., Ltd.—Capital, £11,000 in 10,000 preference shares of £1 and 20,000 ordinary shares of 1s. each. Return dated November 30th, 1929. 2,027 preference and 11,500 ordinary shares taken up. £2,027 paid on the preference shares. £575 considered as paid on the ordinary shares. Mortgages and charges, nil.

S. Kalisky (Aldgate), Ltd.—Deposit on February 8th, 1930, of deeds of 72, Brideoak Street, Cheetham, Manchester, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Malay & Eastern Power Development Co., Ltd.—Capital, £40,000 in 10,000 "A" preference, 29,000 "B" preference, and 1,000 ordinary shares of £1 each. Return dated December 31st, 1929. 5,000 "A" preference, 29,000 "B" preference, and 1,000 ordinary shares taken up. £35,000 paid. Mortgages and charges, $122,275 (Malayan currency).

Alldays & Onions, Ltd.—Capital, £50,000 in £1 shares. Return dated November 18th, 1929. 33,077 shares taken up. £33,077 paid. Mortgages and charges, £35,000.

East India Tramways Co., Ltd.—Capital, £150,000 in 15,000 preferred ordinary, 35,000 ordinary, and 100,000 deferred shares of £1 each. Return dated December 11th, 1929. 7,476 preferred, 33,433 ordinary, and 100,000 deferred shares taken up. £7,483 paid on 7,476 preference and 7 ordinary shares. £133,426 considered as paid on 33,426 ordinary and 100,000 deferred shares. Mortgages and charges, nil.

Kye Electrical, Ltd.—Capital, £25,000 in 20,000 cumulative participating preference shares of £1 each and 100,000 ordinary shares of 1s. each. Return dated January 1st, 1930. 12,502 preference and 92,500 ordinary shares taken up. £17,127 paid. Mortgages and charges, nil.

H. N. Hornsey, Ltd.—Capital, £1,000 in £1 shares. Return dated December 16th, 1929. 625 shares taken up. £282 paid. £343 considered as paid. Mortgages and charges, nil.

Electric Supply Company of Victoria, Ltd.—Capital, £325,000 in 175,000 preference and 150,000 ordinary shares of £1 each. Return dated November 14th, 1929. All shares taken up. £50,007 paid. £249,993 considered as paid. Mortgages and charges, nil.

Sun Electrical Co., Ltd.—Capital, £100,000 in 20,000 preference, 30,000 preferred ordinary, and 50,000 ordinary shares of £1 each. Return dated November 29th, 1929. 17,616 preference, 28,042 preferred ordinary, and 27,912 ordinary shares taken up. £73,570 paid. Mortgages and charges, £20,918.

British Brown-Boveri, Ltd.—Capital, £50,000 in £5 shares. Return dated November 28th, 1929. All shares taken up. £21,250 (£2 10s. per share) paid on 8,500 shares. £7,500 considered as paid on 1,500 shares. Mortgages and charges, nil.

City Notes.

English Electric Co., Ltd.

We reported last week that the holders of the company's debenture stocks and shares had approved the scheme of capital reconstruction which was outlined in our issue of February 7th (p. 264). Owing to the absence of a quorum the meeting of the holders of the 5½ per cent. debentures was postponed.

Mr. W. L. Hichens (chairman) presided and, in proposing the necessary resolutions, said that it had been apparent since the heavy losses which were disclosed in the balance sheet for 1927 that the financial reorganisation of the company must be undertaken at the appropriate moment. The most urgent need at that time, however, was to reduce the fixed charges of the company, and as a result of the economies that had been made the losses which were in 1926 and 1927 £123,000 and £134,000, respectively, were reduced to £33,000 in 1928. There were four ways in which further improved results could be obtained: the reduction of fixed charges by a financial reconstruction; the installation of improved machinery; the expansion of the company's turnover; and a greater concentration upon research. The proposed scheme would enable important advances to be made in each of these directions. It was clear that the company was over-capitalised and the result of the scheme was to write down the existing capital by £1,755,000. The main reason why the earning capacity of the company had proved unequal to its present capital burden was the heavy drop in prices, and consequently in values, which all the basic industries had suffered from since 1921. The B.E.A.M.A. had recently shown that the prices of electrical products had fallen on the average by more than 50 per cent. during that period. It was obvious that so great a shrinkage in prices must have far-reaching effects on the earning capacity and capital values of a company such as the English Electric Co. It was clear that the earning capacity of the company was insufficient to meet the whole of its present fixed charges, and the only method which promised success was to lighten the immediate burden of debenture interest, sinking fund and bank interest and to provide against the possible accumulation of arrears of preference interest during the period of reconstruction. The present scheme made practical provision for these points and would result in a reduction in charges for interest and sinking fund from £182,000 per annum to £72,000 per annum. As regarded the provision of new machinery, the new capital of £750,000 which Messrs. Lazard Bros. would provide was sufficient not merely to liquidate the indebtedness of the company to its bankers, thereby relieving fixed charges, but also to enable important improvements to be carried out, which would have a material effect in reducing costs. To secure a bigger turnover of business the company required strong allies and unquestioned financial stability. The present scheme fulfilled both those requirements. As regarded research, the company had suffered in the past because, though much had been done, it had not been able to establish sufficiently close contact with the experimental side of the industry, either through alliance or by its own efforts. It would be possible in the future to remedy that defect, which was largely due to lack of money. In conclusion, Mr. Hichens pointed out that the market value of the preference shares at the beginning of December, before the scheme was made public, was 7s. 6d., whereas the new par value would be 12s. 6d. In view of the fact that the new preference shares would be buttressed by the £750,000 of new ordinary shares which Messrs. Lazard Bros. would subscribe, and assuming that the new ordinary shares might reasonably be expected to yield in course of time a satisfactory return, it was a fair inference that the new preference shares would in time have a market value at least equal to their nominal value.

In reply to questions regarding the intentions of Messrs. Lazard Bros. with regard to the future management of the company, Mr. Hichens said that it was a condition of the scheme that the present directors should place their resignations in the hands of Messrs. Lazard Bros., and although he had no knowledge in the matter, it was to be assumed that they intended to make certain changes. His opinion of the transaction was that Messrs. Lazard Bros. knew that the company, if properly financed and managed, would be a profitable concern.

At a subsequent meeting of the 6 per cent. convertible debenture stockholders, Mr. Hichens dealt with the scheme as it affected them. He said that the scheme did not propose an alteration in the par values which existing debenture holders would receive, for the par value in both cases would be £100. But it did propose an alteration in the form of security. If the scheme was as successful as the experts believed, the market value of the new securities would rise to par or above, with the result that every present 6 per cent. debenture holder of £100 would be able to realise his £100. He could not do that to-day; the market value in December was about £70. If the present proposal were not accepted the scheme would break down, and the company would be faced, in all probability, with the alternative of liquidation at no distant date. The general approval in the columns of the Press, as well as from a very large body of shareholders and convertible debenture holders was a convincing proof of the soundness and fairness of the proposals.

The "Underground" Group.

The reports of these companies were reviewed in our last issue (p. 405). On February 27th the combined annual meeting of shareholders was held, Lord Ashfield, the chairman, presiding. Addressing the meeting, the chairman said that the traffic during the past year, as measured by the number of passengers carried, showed a small advance upon that for 1928. The total number of passengers carried by railway, tramway, and omnibus amounted to 2,175,000,000. The tramways carried 9 per cent. of this total, the railways 18 per cent.,

and the omnibuses 73 per cent. The passengers carried by the railways increased by 7 per cent., by the tramways by 4 per cent., and by the omnibuses by just over 1 per cent. Perhaps the most satisfactory feature was the increase in the traffic carried by the tramways. It had been the habit in recent years to depreciate the value of the services rendered by the tramways, but if steps were taken to increase the comfort of tramcars, and the general speed of operation, the passengers carried would increase in numbers. The total car-miles run by the companies was 281,000,000, an increase of 67,000,000, and the cost per car-mile had fallen from 12.27d. to 12.25d. A transformation had been effected in the position of the railway companies; but even now, with the changes which had taken place, they needed assistance through the common fund in the payment of dividends. This transformation had been effected without loss or injury to employés. Rather there had been a gain to them, for, with rare exceptions, they had been able to pay them higher wages and provide them with more skilled occupation. The delays on the railways were down to four minutes per 10,000 car-miles run. That was a record and was mainly due to the great care and attention paid to the rolling stock. Referring to the growth of London traffic, the chairman stated that the journeys per head of the population were 512, as compared with 507 in 1928. The rate mounted upwards, while the financial resources were stationary. Since 1918 the group of companies collectively had spent £29,000,000 upon the provision of traffic facilities, which had been possible by taking advantage of the special provisions made from time to time by the Government to aid such expenditure. Once more they were able to avail themselves of an opportunity of the sort, and had put before the Government a programme for raising and expending capital to the extent of some £13,500,000 for the extension and completion of the Underground system. They were compelled to expand, and it was impossible to stand still. Referring to the Minister of Transport's statement that he was seeking a plan for the complete consolidation upon fair and equitable terms of the passenger transport agencies, Lord Ashfield said they were prepared to explore all roads which might lead towards the solution of the London traffic problem, and were prepared to give the Government their loyal co-operation in any proposals that it might bring forward, if those proposals were not prejudicial to their interests or injurious to the undertakings. The report and accounts were adopted.

Northampton Electric Light and Power Co., Ltd.

Presiding at the annual meeting of this company on February 28th, Mr. F. N. Thornton (chairman), in presenting the report and accounts, said that the capital expenditure during the year was £122,255, of which £69,865 had been spent on mains, bringing the total up to £1,385,513. During the past five years nearly £700,000 had been spent on capital works, an average of about £140,000 each year. The h.p. and distributing mains now extended to 378 miles, an addition of 57 miles during the year, exclusive of the mains owned by the associated companies. Approximately 40 miles of h.p. and l.p. mains had been laid in the area covered by the Brackley, Buckingham and Winslow Order. The distributing plant and goodwill of the Buckingham Electric Light Co. had been purchased, and the supply to all the consumers taken over. Many new consumers had since been added and Brackley and four villages in that neighbourhood had also been connected. The use of cookers, which were let out on hire, had grown enormously. Many large country houses and even cottages used no other form of cooker and electric water heaters. They were being pressed on all sides to carry supply to numerous villages in the large area, and these applications were receiving careful consideration. The report and accounts were adopted.

St. James' & Pall Mall Electric Light Co., Ltd.

The annual meeting of this company was held on February 25th. The Rt. Hon. Gerald W. Balfour (chairman), who presided, in presenting the report and accounts (Electrical Review, February 14th, p. 313), said that the largest items of capital expenditure (£80,000) during the year were for machinery and fixed plant and for mains necessitated by the change-over to the new standard distribution system. In connection with the work of change-over from d.c. to a.c., up to the end of 1929 connections to the a.c. system of 7,304 kW had been made, equivalent to 20 per cent. of the total connections to date. Electrical energy purchased increased by nearly 6,000,000 kWh at a cost of £16,189, and the cost per kWh purchased from the London Power Co. fell from 0.794d. to 0.776d. The drop in revenue was due to two substantial reductions effected in tariffs during the year, one in the lighting charges and the other in the charge for power, heating, and cooking purposes. The charges for all classes of supply were now considerably below the pre-war level. The average price obtained per kWh was 2.054d., as compared with 2.414d. in 1928. The report and accounts were adopted.

North Metropolitan Electric Power Supply Co.

Lord Ashfield (chairman) presided at the annual meeting on February 25th. In presenting the report and accounts (Electrical Review, February 21st, p. 357), the chairman said that the year under review had been one of considerable progress, the capital expenditure amounting to £545,810. Since 1924 the expenditure on extensions and improvements had totalled £3,296,000, an average of, roundly, £658,000 per annum. The electricity sold had increased from 96,500,000 to 199,700,000 kWh, and the revenue derived from sales from £616,000 to £989,000, while the average price per kWh in 1924 was 1.53d., compared with 1.19d. for the past year. At the end of 1924, there were 17,000 consumers, as compared with 58,800 at the end of 1929. The company supplied electricity in an area of approximately 660 sq. miles, with a population of over 1,000,000. Apart from a number of authorities who received a bulk supply, it was now operating 25 separate undertakings. Reductions in the electricity charges were to be made from the end of the present quarter of ¼d. per kWh for lighting (flat rate) in the near London districts, and 1d. per kWh (flat rate) in the more remote districts. Corresponding reductions in all other rates were also to be made. The report and accounts were adopted, and at an extraordinary meeting which followed approval was given to the board's proposals to issue an additional 250,000 6 per cent. cumulative preference shares of £1 each, and up to £750,000 of further 5½ per cent. debenture stock.

Mather & Platt, Ltd.

The accounts of this company were abstracted in our last issue, p. 407; the annual meeting was held on February 28th. Mr. L. E. Mather (chairman), who presided, said there had been a larger turnover in all departments, but the better prospects were short-lived, a falling-off in orders having taken place in the last quarter. The directors had continued to make technical improvements, so that the productive capacity was ever increasing. The general trade outlook for the present year, both at home and abroad, was not so far encouraging. Besides the conditions in Lancashire, there was serious depression in important markets such as India, China, Brazil, and Poland. The re-opening of diplomatic relations with Russia gave them confidence that more business might now be possible. The possibilities of further trade in that country were very considerable. He regretted that technical assistance was being drawn upon more freely from America and Germany than from Great Britain, and it was high time that more determined steps were taken by British manufacturers. The report and accounts were adopted.

Enfield Cable Works, Ltd.

The report for the year ended December 31st last shows a gross profit of £142,026 and a net balance of £161,059 (including £31,650 brought forward). The allocations include £20,000 to reserve (making £160,000) and £5,000 to income tax reserve. A final dividend of 10 per cent. is to be paid on the ordinary shares, together with a bonus of 5 per cent., making a total distribution of 25 per cent. for the year. For the preceding eighteen months the distribution was 30 per cent. (at the rate of 20 per cent. per annum). In March last the company issued to shareholders 100,000 £1 ordinary shares at the price of £2, representing a substantial bonus. It is now proposed to issue a further 50,000 shares to shareholders at the same price on a one-to-seven basis. It is announced that Sir George Sutton, Bt., has retired from the board. The annual meeting of the company is to be held on March 26th.

Lancashire Dynamo and Motor Co., Ltd.

After providing for depreciation, obsolescence and debenture interest, the accounts for the year ended December 31st last show a profit of £18,158, as compared with £21,003 for 1928. To this is added £7,809 brought forward, making £25,967. The allocations include £5,000 to reserve (as for 1928) and the dividend on the ordinary shares is maintained at 5 per cent.; the amount carried forward is £7,227. The report states that during the year extensions were made to the works of the Crypto Co. and a further 12,250 of that company's ordinary shares were taken up by the Lancashire Co. Severe competition in the trade continued throughout the period, reducing prices to an unremunerative level. In view of this, the year's results are considered to be satisfactory. The amount of orders on hand is greater than has been the case for a considerable time. Meeting, March 11th.

London Electric Supply Corporation, Ltd.

The accounts for the year ended December 31st last show a profit of £171,833, as compared with £178,880 in the preceding year. To this are added a balance brought forward of £25,437, and interest from investments, &c., of £46,939. After deducting interest and sinking fund instalments, a balance of £186,721 is available (against £181,206). The final ordinary dividend is 5 per cent., making 9 per cent. for the year; £35,000 is transferred to ordinary shareholders' benefit (sliding scale) fund; and £46,832 is carried forward. The electrical energy sold increased by 22 per cent. to 248,144,007 kWh, and the average receipts per kWh sold fell from 0.816d. to 0.705d.

Midland Counties Electric Supply Co., Ltd.

The annual meeting of this company was held on March 3rd, Mr. G. Balfour (chairman) presiding. In presenting the report and accounts (Electrical Review, February 28th, p. 406), the chairman said that in 1919 the company had invested in its properties £847,500, and at the end of the year under review the figure was £4,340,800, of which 88 per cent. was in electric light and power property. The trading balances were £48,391 and £349,209, respectively. The electrical energy sold during the past year was 165,602,000 kWh, an increase

of 24 per cent. as compared with 1928, and three times the output for 1924. The number of consumers connected totalled 26,181, an increase of 5,604, and the maximum load was 51,600 kW, compared with less than 5,000 kW in 1919. Extensions to the transmission and distributing systems involving the provision of 118 miles of e.h.p. lines and 135 miles of l.p. distributors were brought into operation during 1929, making the total route miles 746 and 598, respectively. The generating plant now installed in the three power stations had a total capacity of 90,000 kW, including a 25,000-kW set which was put into operation at Spondon last summer. Application had been made for additional generating plant. During the year 250,000 ordinary shares were issued at a premium of 6s. per share. Referring to the Coal Mines Bill, the chairman said if it was passed in its present form it was very probable that the cost of coal would be increased. The company's generating plants consumed 154,000 tons of coal during 1929, so that every shilling per ton increase meant a burden upon the user of electricity of nearly £8,000 per annum. The report and accounts were adopted and at a subsequent meeting resolutions were passed increasing the capital from £4,000,000 to £4,500,000 by the creation of 500,000 new shares of £1 each.

Westminster Electric Supply Corporation, Ltd.

The annual meeting was held on February 25th, Lord Wargrave (chairman) presiding. In presenting the report and accounts (*vide* Electrical Review, February 21st, p. 358), the chairman said that the output of electricity continued to expand, and during the year 11¼ million kWh more was sold than in 1928, an increase of 20 per cent. The cost of replacing consumers' d.c. apparatus in the change of system had increased by £35,405, and the expenditure under this heading was being written off out of revenue over the period during which the work would be carried out. The revenue from the sale of electricity was up by £64,000, while the purchase of energy had increased by £41,000. The revenue derived from consumers during the year was £175,000 below what would have been received if the standard price had been charged. The report and accounts were adopted.

Midland Electric Manufacturing Co., Ltd.

The report which was presented at the annual meeting on February 25th showed a net profit of £45,182, as compared with £43,402 for 1928. The ordinary dividend is maintained at 10 per cent., but the bonus is reduced from 25 to 12½ per cent. During the year £37,500 of the reserve was capitalised and allotted to shareholders in the form of one ordinary share for each two shares held, and these new shares participate in the 1929 dividend.

Shropshire, Worcestershire, and Staffordshire Electric Power Co.

The directors recommend the following dividends in respect of the year ended December 31st, 1929: "A" ordinary shares, final dividend of 4 per cent. (actual), making 8 per cent. for the year; "B" ordinary shares, dividend of 7½ per cent. for the year.

Tottenham and District Gas Co.

Presiding at the annual meeting on February 25th, Mr. H. Woodhall (chairman and managing director) said the profit on the electrical side of the business was £16,692, a slight increase on the previous year, in spite of a reduction in the lighting charges. The price charged, 4½d. per kWh, was now lower than in the surrounding districts.

Cable, Telephone and General Trust, Ltd.

The net revenue for the year ended December 31st last was £35,909, to which is added £1,050 brought forward, making £36,960 available. The directors recommend a dividend of 6 per cent., less tax, for the year on the ordinary shares, leaving £3,706 to be carried forward.

Dublin United Tramways Co., Ltd.

The report for 1929 shows a net profit of £48,852, to which is added £13,785 brought forward, making £62,785. It is proposed to pay a final dividend at the rate of 6 per cent. per annum, less tax, on the preference stock, set aside £20,000 towards renewal of track, and to carry forward £12,037.

O. C. Hawkes, Ltd.

The net profit for 1929 was £4,655 (against £12,738). The final ordinary dividend is 2 per cent., making 5 per cent. for the year (against 10 per cent.); the new ordinary shares receive 2½ per cent.

Vickers, Ltd.

A half-yearly dividend of 2½ per cent. has been declared on the company's 5 per cent. stock (less tax), 5 per cent. preference shares (less tax), and cumulative preference shares (free of tax).

Davis & Timmins, Ltd.

The net profit for the past year was £26,068, as compared with £23,417 for 1928. A final distribution of 12 per cent. maintains the ordinary dividend at 20 per cent. for the year.

Waste Heat & Gas Electrical Generating Stations, Ltd.

A final dividend of 5½ per cent. is proposed, making 8 per cent., as for 1928, for the year ended January 31st last.

Stocks and Shares.

Tuesday Evening.

The world-wide contraction in the prices of commodities, and metals, which has so sharp an effect upon the quotations for stocks and shares, must be regarded as the principal reason for the Stock Exchange depression which prevails. Its influence transcends that of the Budget and of politics. Every week adds a fresh item to the list of commodities, metals, &c., that are falling in price for want of sufficient consumption to absorb the articles produced. Economically, this should be a good thing in certain respects for the companies, particularly, which absorb large quantities of raw materials. But the vicious circle ordains that buyers of most commodities are themselves none too well off, and cannot afford to accumulate substantial stocks, however cheaply the latter can be acquired. This influence holds a depressing hand over Stock Exchange securities of most classes; though happily, as noted on previous occasions, the markets for stocks and shares connected with the electrical industry are largely immune from its effects.

Money, and "Money" Stocks.

Talk still continues as to the possibility of the Bank of England reducing its rate to 4 per cent. in the near future. The Government has some heavy financing in front of it, and, no doubt, will be glad of easy monetary conditions in which to work out its problems. There are, however, many new issues of heavy amounts, either just placed on the market, or about to make their appearance. Nor are the rates of foreign exchange sufficiently stable to encourage the Bank of England to reduce the Rate unless the Court can see its way to easy monetary conditions for some few months to come. Prices of gilt-edged stocks are, however, well maintained. There is a reasonable demand for sound scrip such as Central Electricity 5 per cent., 1950-1970, the price of which is 96; and North-West Midlands Joint Electricity fives, of similar date, obtainable at a slightly higher figure.

Stocks on Offer.

There is on offer about £5,000 County of London Electric 5 per cent. debenture stock, obtainable at 99 or thereabouts, giving a return of £5 1s. per cent. on the money. Interest payments are due on June 1st and December 1st, and the security may be regarded as absolute. A small amount of British Electric Traction 4½ per cent. second debenture stock is offered at 84, with May and November interest. This gives a yield of £5 7s. per cent. on the money, and to pay the annual interest takes £13,700, whereas the amount available last year was over £210,000. The stock is redeemable at any time at 105. A higher income can be obtained from Anglo-Argentine Tramways 4½ per cent., obtainable at 72½, where the return is 6¼ per cent. on the money. Interest payments become due in January and July, and on the figures of the last report the service of the stock was covered more than ten times over. Argentine issues are not, however, in great favour at present, owing principally to the heavy fall which has recently occurred in the rate of exchange. The company's 5 per cent. debenture stock at 71½ shows a fall this week of 2 points. Perak River Hydro-Electric Power 7 per cent. participating debenture has strengthened a trifle to 104, a price which gives a yield of practically 6¾ per cent.

Cables and Wireless.

Fresh elements of discord and price depression have been introduced into the market for Cables & Wireless stocks by the Postmaster-General's statement in defence of the use that the Post Office is making of the alternative system to that offered by the Imperial and International Communications. The Postmaster-General stated that the minimum rental asked by the latter for the use of Beam telegraph stations for telephone services is £40,000 to £45,000 per annum, plus a royalty in certain circumstances. He maintained that this was too expensive, and that the work could be done much more cheaply by working the same services from Rugby. Mr. Baldwin pressed for a discussion, and, in the Stock Exchange next day, falls ranging from 3 to 5 points occurred in the stocks of Cables and Wireless "A" and "B" ordinary. The "A" fell from 63 to 55, and the "B" dropped from 30 to 24, while the preference went back to 94. From these prices there was a rally, and the changes on the week represent losses of 4 and 3 points, respectively, on the two ordinary stocks.

Telephone and Telegraph.

Globe Telegraph ordinary continue a weak market. The company has declared the usual quarterly dividends. Marconi Marines are better at 2¾. Canadian Marconis jumped to 30s., and reacted to 1½, leaving them 3s. 9d. higher on the week. American Telephone & Telegraph stock at 245 is 5 points up: International Telephone & Telegraphs at 70 are 2½ points lower. Jutland Telephone 5½ per cent. bonds, guaranteed by the Danish Government, changed hands a few days ago at 101½, the price including the half-yearly interest due in the course of a week or two. Business has been marked in Marconi's ordinary shares at 57s. to 57s. 6d. British Columbia Telephone 6 per cent. preferred rose to 104½, and the company's 4½ per cent. first mortgage debenture stock to 88½. American stocks in this section are generally better. New

York Telephone 4½ per cents. strengthened to 100. In sympathy, United River Plate 4½ per cent. debenture advanced to 88¼. Of the British stocks, Anglo-American preferred is a little easier at 101½.

Home Railways.

The meetings of the Home Railway Companies have provided interesting reading, and Lord Ashfield takes a wide view of a transport company's duty when, in referring to the steady growth of the Metropolis, despite trade depression and falling birth rate, he says that this imposes an increasing responsibility upon an enterprise which has been, in a sense, one of the greatest creators of Metropolitan growth. The onus of discovering what, at best, can only be a transient solution of the London traffic problem has now been taken over by the Government, and Lord Ashfield expressed his assurance of the company's willingness to collaborate in any sound and equitable scheme. People who deride the tramways are likely to be surprised at the increase of more than 4 per cent. shown in the London tramways' traffics for last year, though it is the 'buses which constitute the predominant partner. In petrol tax, Lord Ashfield says, and licensed vehicle duty alone, the L.G.O.C. omnibuses last year contributed £815,000 to the State. The price of Underground Electric income bonds at 107 ex dividend is about 1⅛ higher on the week. The only other change in this market is a further recovery in Metropolitan ordinary to 65. General Baring made an interesting speech at the annual meeting of the Southern Railway, and a great part of his pronouncement was taken up with a reflection of the Board's intentions in regard to electrification of the Southern services from London to Brighton and to Worthing. The completion of the scheme is scheduled for 1932.

Electric Power in Canada.

Brazilian Tractions strengthened to 38½ and Hydro-Electrics to 44¼ xd. There has been a more decided tendency than of late to buy American and Canadian utilities. The demand is principally in respect of speculative stocks and shares. Montreal Light & Power has fallen 2 points to 138½. Consolidated Gas & Electric of Baltimore remain at 115. Shawinigan shares have rallied to 78; Power Corporation of Canada are lower at 75½. It may be observed, in passing, that stocks and shares connected with Canada, particularly where they are of purely investment order, command relatively high prices in the market to-day, the explanation for this being that there is a consistent demand for such issues in Canada as well as from New York. Holders of the Montreal Water and Power 4½ per cent. first mortgage prior lien gold bonds have been offered 100½ per cent. net for their interest. There are, however, buyers in the Stock Exchange at 102, the price having risen since the offer was made by the Royal Bank of Canada. British Columbia Power "A" shares are neglected at 38½, the "B" keep at 16¼.

The Mexican prices are irregular. Improvement in Mexican Light & Power 7 per cent. preferred is offset by a fall in the company's common shares. Mexico Tramways have dropped to 20¼.

Manufacturing Companies' Shares.

The Enfield Cable Works has done exceedingly well in the past year, and the dividend, with bonus, making 25 per cent. for the year, is an increase of 5 per cent. on the relative rate in the case of a year ago, which was 30 per cent. for the previous 18 months: that is to say, at the rate of 20 per cent. per annum. The company proposes to repeat its offer of twelve months ago in the shape of new shares. This time, 50,000 new ordinary are to be offered at £2 per share, the proportion being one new share for every seven shares at present held. This in itself constitutes a very pleasant bonus, but the price of the shares reacted to 96s. 3d. Telegraph Constructions fell £1 to 25½, the recent rise having been somewhat too rapid. A fall of 3s. 9d. lowered Electric Constructions to 11s. 3d., and dealings have been marked in the preference at 18s. Crompton Parkinsons are better at 22s. 6d. Callenders fell ½ to 3⅛, and British Aluminium ordinary remain dull at 43s. 3d. There is not a great deal doing as a whole in this market. Falls have also occurred in Henleys and in India-Rubber shares. Ever-Readys eased off to 17s. The dulness is explained by dealers in the market as being due more to general conditions than to any specific cause.

Miscellaneous Matters.

Movements amongst the shares of the home electricity companies are small, and of no particular significance. Electric Supply Corporation shares fell 1/16 to 45s. 9d. British Power and Light show no recovery at 11s. There are rises of 6d. each in Kensington ordinary and London Electrics. No particular changes have occurred in the provincial list. Several more good reports have appeared, without affecting prices to any noticeable extent. The Midland Counties Electric Supply proprietors have duly sanctioned the increase of capital to 4½ million pounds sterling. In the British tramway group, London & Suburban Traction ordinary receded to 2s 6d. Yorkshire (West Riding) 4½ per cent. stock gave way a couple of points to 55½. London General Omnibus income debenture at 95½ is the fraction harder. The iron and steel market is quiet. Amongst rubber shares, the tendency, after being rather better on an improved outlook for the product, turned tail upon a reaction in the price of rubber, which took down the price to a shade below 8d. per lb.

Share List of Electrical Companies.

	Nom.	Approx. Dividend, 1927.	1928.	Price Mar. 4 1929.	Rise or fall	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	15	15	8⅞	—	4 18 0
Brompton Ordinary	£1	8½	8½	25/6	—	5 9 10
Charing Cross Ordinary	£1	8½	8½	26/-	—	5 7 8
do. do. 4½% Pref.	£1	4½	4½	17/-	—	5 6 0
Chelsea	£1	8¾	8¾	25/-	—	5 12 0
City of London	£1	10	10	22/-	—	4 7 6
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Clyde Valley	£1	8	8	28/9	—	4 8 3
County of London	£1	7	10	44/6	—	4 10 0
do. do. 6% Pref.	£1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	£1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	£1	11	11	45/9	—1/16	4 13 7
Kensington Ordinary	£1	8	8	26/6	+6d.	5 5 8
Lancs. Light and Power	£1	7½	7½	27/-	—	5 11 1
London Electric	£1	6½	9	27/-	+6d.	5 3 8
Metropolitan	£1	9	10	2	—	5 0 0
do. 4½% Pref.	£1	4½	4½	17/-	—	5 6 0
Midland Counties	£1	6½	7	23/-	—6d.	5 9 0
Mid. Elec. Power	£1	15	8	32/6	—	4 18 6
Newcastle-on-Tyne Ordinary	£1	6	6	23/9	—	5 1 1
do. 7% Pref.	£1	7	7	25/6	—	5 9 10
Notting Hill 6% Pref.	£10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	£1	6	6	23/-	—	5 9 1
St. James' and Pall Mall	£1	8	8	26/6	—	5 5 8
Scottish Power	£1	8	8	29/-	—	5 6 8
South London	£1	8½	8½	26/6	—	5 4 10
Urban Ordinary	£1	7	7	33/9	—	4 2 10
Westminster Ordinary	£1	8½	8½	25/6	—	5 9 10
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	24/-	—	5 5 0
Yorkshire Elec.	£1	8		32/-xd	—	5 0 0
Home Rails.						
Central London Ord. Assented	Stock	4	4	73	—	5 9 7
Metropolitan	£	3½	4	65	+½	6 3 1
do. District	£	4	5	74½	—	6 15 2
Underground Electric	£1	7	8	23/-	—	6 19 2
do. do. Income	Bonds	6	6	107xd	+1⅛	5 12 1
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	101½	—1	5 18 3
do. Def.	£	1½	1½	24½	—	6 4 0
Automatic Telephone	£1	19	19½	97/6	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	—	96	—	5 14 8
do. A 7½ Ord.	£	—	—	58½	—4	... ...
do. B Ord.	£	—	—	27½	—3	... ...
Globe Tel. and T. Ord.	£10	10	10	21½	—	*4 13 0
do. do. Pref.	£10	6	6	11¼	—	5 7 10
Great Northern Tel.	£10	20	20	30½	—	6 11 2
Marconi-Marine	£1	19½	15	2⅛	+⅛	... ...
Oriental Telephone Ord.	£1	12	12	2½	—	*4 5 5
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	6½	8⅛	—	8 19 6
do. do. 2nd Pref.	£5	6	6	8⅛	—	9 16 0
do. do. 5% Deb.	Stock	5	5	71½	—2	6 19 10
British Electric Traction Def. Ord.	£	5	5	157/6	—	... ...
do. do. Pref. Ord.	£	8	8	124½	—	6 8 6
Brazil Traction	£100	7	8	38½	+1	5 4 0
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	90½	—	5 10 6
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	10/6	—	... ...
London United Tram Deb.	Stock	4	4	59½	—	7 13 4
Mexico Trams, 5% Bonds	—	5	5	66½	—	7 10 5
Mexican Light Common	£100	Nil	Nil	70	—3½	... ...
do. 7% Pref.	£100	7	7	75½	+4	9 5 6
do. 1st Bonds	—	5	5	74½	+2	6 14 3
Victoria Falls Ord.	£1	15	15	2½	—	5 2 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... —
Manufacturing Companies.						
Assoc. Elec. Ord.	£1	8	—	26/6	—	4 10 7
Babcock & Wilcox	£1	18	18	3	—	*5 0 0
British Aluminium Ord.	£1	10	10	43/3	—	*4 12 6
British Elec. Transformer Pref.	£1	7	7	10/-	—	... ...
British Insulated Ord.	£1	15	15	3½	—⅛	4 0 0
Brush Ord.	Stock	10	10	126½	—	7 18 1
Callenders	£1	15	15	3⅜	—⅛	4 2 8
do. 6½% Pref.	£1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Ord.	£1/-	—	90	22/6	—1/-	6 13 4
do. 8% Pref.	£1	8	8	25/-	—	6 8 0
Edison-Swan 1st Pref.	£1	7½	7½	24/6	—	7 1 8
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	£1	7½	5½	11/3	—1/16	9 15 6
Enfield Cable Ord.	£1	20	20	4½	—⅛	4 8 4
English Electric	£1	Nil	Nil	3/9	—	... ...
do. do. Pref.	£1	8	Nil	7/6	—	... ...
Gen. Elec. Pref.	£1	6½	6½	24/-	—	5 8 4
do. Ord.	£1	10	10	34/-	—	4 6 7
Henley	£1	25	20	6	—⅛	5 0 0
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 8
India-Rubber	£1	Nil	Nil	10/-	—⅛	... ...
Johnson & Phillips	£1	10	—	36/3	—	5 10 3
Siemens Ord.	£1	7½	7½	26/-	—	5 0 0
Telegraph Construction	£2	10	10	25½	—1	*4 14 0

*Dividends paid free of Income Tax.

The British Industries Fair.—IV.

Some Notes on the Exhibits, Visits, and Functions at London and Birmingham.

As we mentioned in our last issue, preparations for the 1931 Fair at Birmingham have already commenced, the period of the Fair having been decided upon—from February 16th to 27th. In a letter to this year's exhibitors the general manager, Mr. C. Elliott, says that the success of the Fair is undoubted. The attendances have greatly increased and exhaustive inquiries made among exhibitors prove that almost without exception good results have been obtained. Considerable thought has already been given to an all-round increase of activities for the 1931 Fair, and it is hoped that the improvements made this year in publicity, organisation, &c., will be considerably amplified. Present exhibitors will be given until May 1st to make a decision; after that date newcomers will be admitted.

The Chloride Electrical Storage Co.'s Stand.

The preponderance of engineering exhibits at Birmingham led Mr. H. H. Humphries, the Birmingham City Engineer, to suggest at a luncheon given to a gathering of borough engineers and surveyors that the bi-annual municipal engineering exhibition held at Olympia should become a separate section of the Birmingham Fair.

While at the same luncheon Sir Arthur Balfour deplored the present state of British industry generally, at the luncheon given to representatives of electrical organisations on the same day the prosperity of the electrical industry was stressed by all the speakers.

At the conference which preceded luncheon Mr. Willoughby-Ellis, president of the Electrical Contractors' Association, took the opportunity of laying further emphasis upon the points which he raised in a speech at the Association's recent annual dinner. He showed that, although electricity in this country had made a rapid advance, the rate of progress would have been even greater had it not been for the lamentable lack of standardisation from which the industry had suffered from its earliest days. Industry and the railways offered tremendous scope for the further employment of electricity, but, although most existing handicaps could be overcome, there was a great deal of conservatism to be contended against, especially on the part of railwaymen. The latter, however, should be influenced in favour of electricity by the excellent results obtained from electrification by the Southern Railway.

Dealing with the vast potentialities of the domestic field, Mr. Willoughby-Ellis maintained that in this country with its rapidly-varying climate electricity had a very considerable advantage as as a form of heating. After stressing the necessity for economic rates of charging for electricity, and adequate wiring in the home, the speaker drew attention to the need for a "Central Council of the Industry" to co-ordinate and direct the activiities of its various sections.

At the conclusion of the Fair on February 28th a statement regarding its achievements was issued by Mr. E. W. Bache (chairman of the Management Committee of the Birmingham Section). He said that everyone agreed that so far as Birmingham was concerned this year's Fair had been the most successful of the series. The Fair Management Committee had been in close contact with a large number of exhibitors during the period of the Fair, and upon the available information there was justification for the statement that the amount of business done had been satisfactory, and that the number of trade inquiries has been in excess of last year. Many exhibitors had already applied for increased space for 1931 and it would become necessary further to extend the exhibition buildings.

The Display of the Birmingham Corporation Electric Supply Department at Castle Bromwich.

A Second Electrical Day at the Fair.

Visit of Electrical Organisations.

On Thursday last week the electrical industry was well represented at the Birmingham Section of the Fair. Sir John R. Brooke, Electricity Commissioner, and Mr. J. K. Brydges, president of the I.M.E.A., were among the visitors, as well as Sir Arthur Balfour, who was chairman of the Government Committee on Industry and Trade. The organisations represented were the Institution of Electrical Engineers (South Midland Centre), the Incorporated Municipal Electrical Association (Council), the Association of Consulting Engineers, the

A " Magnet " Baking Oven used at the Fair.

Association of Supervising Electrical Engineers, the Electrical Contractors' Association, the Electrical Contractors' Association of Scotland, the Electrical Wholesalers' Federation, the Electrical Merchants' and Manufacturers' Association, the Association of Mining Electrical Engineers, and the Illuminating Engineering Society. Many municipal engineers were also present as members of the Institution of Municipal and Borough Engineers.

A conference was held during the morning and at this there was a fairly good attendance; Mr. J. Wilson (president of the E.W.F.) presided.

Mr. T. R. Martin, chairman of the Electrical Advisory Committee, extended a welcome to the visitors on behalf of the Fair Management Committee, and said that many of them felt that it would be an advantage if it could be arranged for the Fair to be held a month or two later than at present. On behalf of the civic authorities of Birmingham a welcome was accorded by Mr. E. J. Jennings (Birmingham Electric Supply Department), who is secretary of the Electrical Advisory Committee.

The chairman, thanking the speakers, testified to the excellent work of the latter committee, and added that they did not spare themselves to explore every avenue to promoting the greater use of electricity and, incidentally, the welfare of those in the industry.

Mr. H. Willoughby-Ellis, president of the Electrical Contractors' Association, then read a paper on " Current Electrical Development," which is dealt with elsewhere in this issue.

After the conference the delegates were entertained to luncheon, and Mr. Walter Barrow, president of the Birmingham Chamber of Commerce, presided. In submitting the toast of the visiting associations, he said the Electricity Commissioners were wise in insisting upon the whole country changing over to one frequency. This would be of immense importance in the home and factory alike.

Sir John R. Brooke, responding to the toast, said that the electrical industry was doing well and was going to do better. In engineering it was now second only to the automobile industry. They had an annual output valued at eight millions sterling, and their export trade had risen in a perfectly straight line from 1920 to the present day, and last year reached a figure of something like twenty millions sterling. The industry was directly employing 180,000 hands, and probably as many more indirectly. This prosperity was not merely a flash in the pan; all over the world similar development was proceeding. Electricity was in a position to offer essential services to the world, and so long as that service could be offered, and it was recognised that the only road to success was to electrify, continued expansion was assured. They were equipping power stations all over the world. They were taking part in practically every great railway electrification scheme outside Europe and the United States, and the orders on hand at present represented a much greater horse-power than at any time in the history of the industry. Owing to the development of the Grid our manufacturers were being placed in a far stronger position than ever before to deal with manufacturers' requirements. There had been established a home market for h.p. transmission, for switchgear and corresponding constructional work, and our manufacturers could proceed with renewed confidence.

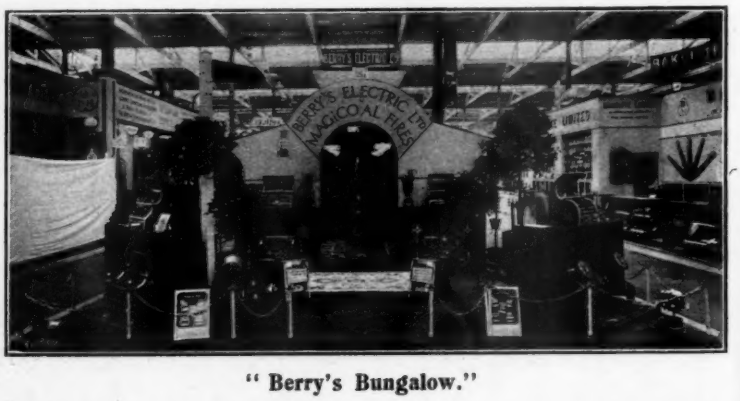
Mr. J. K. Brydges also replied to the toast, and confirmed Sir John Brooke's views of the electrical industry. Mr. J. H. Thomas, when he called together representatives of the electricity supply authorities to discuss with him ways and means of assisting him in his proposed scheme for the relief of unemployment, said that the business of electricity supply was one of the most prosperous industries in the kingdom and those responsible for it should use every endeavour to accelerate schemes and extensions to encourage the development and uses of electricity in all directions and thus assist in providing work for the unemployed. In conflict with this expression of opinion by one member of the Government, we had another who had not at present been induced to make any statement regarding the continuance or withdrawal of the Safeguarding of Industries Act and the McKenna duties, both of which had without doubt been the means of increasing the prosperity of certain sections of British trade without exercising any harmful effect to the consumer. The present fly in the ointment was the Coal Mines Bill. The electricity supply industry being largely dependent upon coal for the production of electricity, the question of the price of coal was vitally important to the industry. The Government having decided to shorten the miners' hours of work without reduction of wages, the coal owners would be obliged to obtain higher prices for their product. The Bill enabled the coal owners to levy taxation upon any section of the users, not only to make up for the increased cost of production due to shortened hours, but to subsidise the export of coal in order to keep the price down to a competitive figure. Thus the British manufacturer of all classes of goods would be prejudiced in favour of foreign rivals.

Electrical Women's Visit.

On the same afternoon members of the Birmingham branch of the Electrical Association for Women spent an interesting and instructive time at the Fair, as the guests of the Electrical Advisory Committee. Over 200 were entertained to tea. Mr. E. J. Jennings presided and extended a welcome, and Mrs. H. K. Beale, president of the branch, returned thanks for the Committee's hospitality.

Official Figures of Attendance.

In the House of Commons on Monday last Mr. Gillett announced the official figures of attendance at the Fair. He said that the London Section was visited by 150,000 home buyers (against 111,000 last year), 4,800 overseas buyers (against 3,700), and 51,000 members of the public (against 32,000). The Birmingham figures for all classes were 150,000 as compared with 120,000 in 1929. In reply to questions, Mr. Gillett said that every effort was made to prevent the introduction of foreign-made goods into the Fair; and that the invitations to the Fair sent to the Soviet Embassy resulted, so far as the records showed, in the visit of one Russian.



" Berry's Bungalow."

Some of the Exhibits.

A Fourth and Final Instalment of Illustrated Notes.

British Electric Transformer Co., Ltd.

A number of the company's "Tricity" cookers appeared on this stand, including a new model of which particulars are given on p. 384 of our last issue. "Sunray" radiators in a variety of forms were also to be seen. The "No. 752" pattern is a new design equipped with five 200-W lamps and a concealed 600-W element. It is of very handsome appearance and

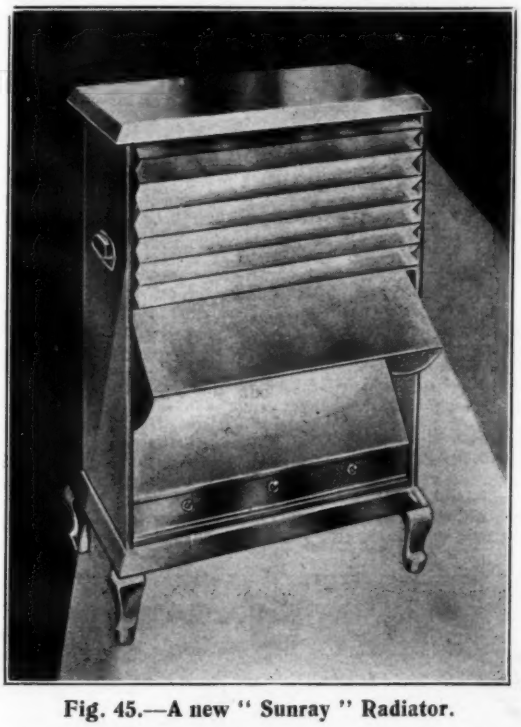


Fig. 45.—A new "Sunray" Radiator.

is suitable for a moderate-sized room. The radiator is illustrated in fig. 45. Imitation coal fires fitted with chromium-plated trough reflectors in which an element is arranged horizontally were also shown. The elements are plugged in and are therefore easily replaced. Other heating apparatus exhibited included examples of the company's original "flame" pattern fires, with strip wire wound on mica formers, and small convector heaters for linen cupboards and similar applications. In addition, the company displayed kettles and other smaller domestic apparatus. Among this was a new type of electric iron.

J. H. Connor & Son, Ltd.

This was another washing-machine company exhibiting in the Canadian section. The "Connor" washer employs a double-walled tank. The inner container is of heavy sheet copper nickel plated on the inside, while the outer case is of steel, and between them is efficient heat insulation. The control of the machine, which employs an "agitator," is simple. After the motor has been started, the washing mechanism is put into motion by depressing a knob in the centre of the agitator. The latter's motion keeps the clothes separated and drives the hot soapy water through them. All the mechanism is well lubricated and totally enclosed. An adaptable wringer of convenient size is provided. The latest model shown on the stand was fitted with an electric heating element, which is not a common feature of electric washers.

Brantford Washing Machine Co., Ltd.

On behalf of this Canadian company, the Sloan Electrical Co. (United Kingdom agents) again exhibited the "Locomotive" electric washer, which was shown for the first time at last year's Fair and described by us then. The copper tank of the machine is mounted on a pair of rails, and by means of a crank on the motor shaft the tank is driven to and fro, the water being given a "figure of 8" motion, which is said to cleanse the clothes very efficiently. A heating element is fitted, and the whole of the equipment is rust-proof.

Beatty Bros., Ltd.

Examples of its well-known electric washing machines were displayed and demonstrated by this company in the Canadian section. The Beatty machine employs a capacious tub in which a reciprocating "agitator" operates. The equipment supplied with it includes an ironing table, a rinsing tub, an electric iron, a ceiling clothes airer, and a clothes basket.

Holden & Hunt.

A representative range of their low voltage spot and butt welding machines were shown on the stand of this company. These machines are simple and practical in design, the electrical efficiency is extremely high, ensuring the maximum possible number of welds per kWh, and will stand heavy over-loads for short periods of time without damage. Many of them are being run on light repetition work by the practically unskilled labour of boys and girls. There is no danger from electric shock, as all high-pressure parts are enclosed within the body of the machine, and in all external parts carrying current, the voltage is very low. Actual meter readings taken over a large number of welds, on clean iron and steel articles, show that current consumption and time are extremely low. It is claimed that nearly all articles built up from sheet steel or iron which would ordinarily be rivetted, can be spot or butt welded at a lower cost.

An interesting exhibit was the No. 4 high-speed butt welder (fig. 46) in which many unique improvements are incorporated. This machine is semi-automatic and pedal-operated, and is capable of welding a large range of steels. It is particularly suited to such work as the welding of brake rods, valve stems, and similar classes of work where accuracy and a high tensile strength of weld have to be obtained over large quantities of product with absolute uniformity. The machine is rated at 15 kW, and will weld at high speed up to ¼ in. dia. mild or

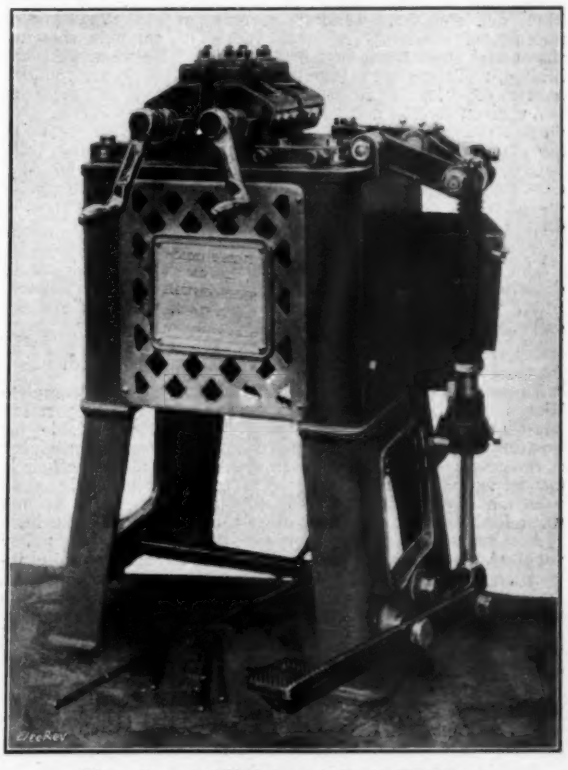


Fig. 46.—A High-speed Butt Welder.

alloy steels. Owing to the small volume of heated metal the energy consumption is less than ordinary butt welding. The speed of welding varies from about half a second to 1½ seconds according to the area of weld and class of metal. The welding is effected by a stroke of the pedal which automatically performs the sequence of operations to complete the weld. It is fitted with a four-way voltage regulator graduated in carefully defined ratios to cover the whole range of welding.

Premier Electric Welding Co., Ltd.

A complete range of arc-welding plant was shown by this company. It comprised examples of the company's drooping characteristic single-operator machine, driven by a four-cylinder "Dorman" engine in one case, and also by d.c. and a.c. motors. In this plant the whole of the switchgear is enclosed in a weather-proof steel box, and so arranged that there is no exposed wiring of any kind. A range of welding transformers with choke-coil regulators was also shown, the two principal examples being a 200-A transformer of the air-

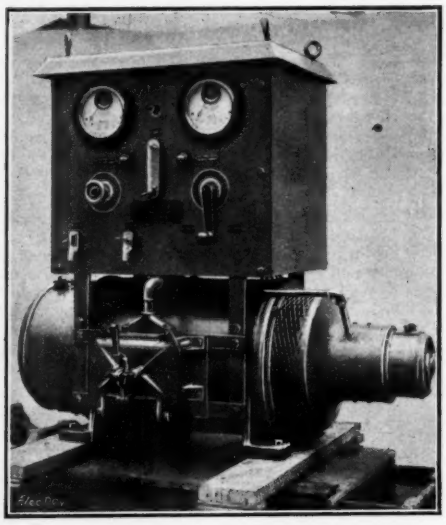


Fig. 47.—A "Premier" Electric Welding Set.

cooled type, and a small 75-A model specially designed for welding thin sheet metal. The energy consumption of the latter transformer is claimed to be almost negligible, permitting of its use on an ordinary a.c. single-phase lighting circuit. Multi-operator type machines were represented by a two-operator motor-generator welding plant. This delivers d.c. welding current at 35 V to any number of welders. A large range of samples showing the special applications of the "Belfinish" electrode were exhibited, including the original test pieces made to the requirements of Lloyd's Register, which resulted in approval being given for the use of the "Premier" system of welding on ship construction work. The "Premag" process for welding copper was demonstrated. This process, which has been worked out in conjunction with I.C.I. Metals, is an oxy-acetylene process for welding copper. We illustrate in fig. 47 one of the a.c. motor-generator equipments which appeared on the stand.

H. C. Slingsby.

The exhibits on this stand included ladders and trucks of all descriptions, many of the latter being electrically operated. There were also electric industrial engines, trackless and for railways, and electrically-operated stackers.

"Rapid" Magnetting Machine Co., Ltd.

The separators shown on this stand included a complete high sensitivity, rotary drum, "standard" type separating machine at work handling metal swarf. It is suitable for treating mixed metal swarf and granular materials containing a considerable percentage of iron. A fixed inside half-circle magnetic unit is surrounded by a revolving brass drum on which a jig-shaken tray feeds the material from a hopper with feed regulation. The diameter of the drum is 14 in.

Another example was the type "P" magnetic pulley separator with magnetic poles disposed circumferentially instead of axially. This is suitable for use on belt conveyors to handle clinker, gravel, stone, &c. The belt as it leaves the pulley automatically throws off the extracted magnetic material separate from non-magnetic. Other exhibits included two types of chute separators, a magnetic clutch, two types of electro-lifting magnets on a gantry with hoist blocks, and a spring cable drum, a foundry sand-separating and sieving plant, and sundry small magnetting apparatus.

Daniel Foxwell & Son, Ltd.

Portable vacuum cleaning plants for use in large buildings were exhibited and demonstrated on this stand. There are several models, but the principles of construction are the same in all. In a strongly-braced steel chassis are mounted the motor and exhauster, with a dust container above. A special feature of the exhauster is the employment of sliding blades which, with their bearings and segments, are carried by floating rings suspended by ball bearings from the cylinder covers. The centrifugal outward thrust of the blades is taken by the segments, and the blades, therefore, although very close to the cylinder walls, do not actually touch. The floating rings being larger in diameter than the bore of the cylinder, the bearings of the blade shoes run in an oil bath, which also acts as a seal between the suction and delivery sides of the exhauster. The outer edges of the blades are radial from the bearing centres, which ensures equal clearance from the cylinder walls in all positions. The extractors are fitted with a sight glass enabling the operation of the machine to be constantly observed.

Super-Electric Heaters (1929), Ltd.

On this stand a selection of domestic electrical appliances formed part of a display of household fittings. Irons, bowl fires and electric towel airers were included among the articles shown.

Birmingham Electric Furnaces, Ltd.

A full scale half section of a large "Birlec" furnace which illustrated the robust method of construction and the special patented heating element employed was included in the exhibits of the above firm. Photographs of some large installations were shown, including furnaces for annealing and general heat treatment of steel and non-ferrous metals, bright annealing, carburising, hardening, &c. The exhibit also included a large box-type "Birlec" furnace, having a usable hearth 9 ft. long by 5 ft. wide and a maximum rating of approx. 180 kW arranged for mechanical charging and used for carburising. Two standard portable "Birlec" furnaces of an entirely new range were shown, both being in operation. The smaller one (fig. 48), model H.C.P.2, which has a hearth 30 in. long by 15 in. wide, and a maximum rating of approx. 18 kW, was shown re-heating steel parts previous to oil-quenching, and the larger model, H.C.P.4.A., which has a hearth 36 in. long by 23 in. wide, and a maximum rating of approx. 30 kW, was shown carburising. Whilst both models exhibited are similar in outward appearance to those shown by the company at last year's Fair, the outstanding difference of this new series (which is in addition to, and does not supplant the previous series) is in the design of the heating elements which are now similar to that employed with success in their larger installations. The system consists of supporting the resistor which is of heavy nickel-chromium strip bent into zig-zag form on heavy gauge hooks of the same metal. In this way there is no contact between the element and the refractory, and all risks of "hot spots" due to masking or of any inter-action between the element and the lining are entirely eliminated, with a consequent very great increase of resistor life. The supports are placed at such frequent intervals that with the heavy gauge of strip employed no sagging or distortion of the elements can take place.

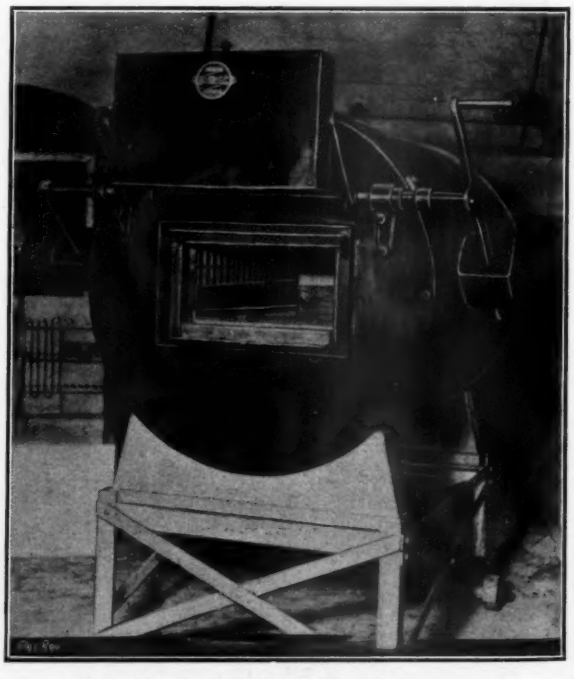


Fig. 48.—A "Birlec" Electric Furnace.

The furnace itself consists of a welded steel cylinder, lined with special shaped refractory and insulating material. Except for the hearth, which is flat, the interior is also circular. This construction allows free interchange of heat by radiation, ensuring even heating, and in addition tends to focus the heat on the centre of the charge so that there is no tendency for the sides of the charge to be heated more rapidly than the middle. The heat insulation consists of "Sil-o-Cel" varying in thickness between 4½ in. and 9 in., according to the size and purpose of the furnace.

Wolseley Sheep Shearing Machine Co., Ltd.

This company exhibited a complete range of its manufactures which included cream separators, horse-clipping and sheep-shearing machines, and petrol and paraffin engines. A feature of the exhibit was electric generating plants—one being a direct-coupled generating set not previously exhibited at the Fair (fig. 49). Interesting points of this set are its exceptionally steady running, the very low speed, and economic consumption of petrol. These make the engine more

Fig. 49.—A Wolseley Lighting Set.

silent, gives it a much longer life, and generally, particularly in connection with lighting sets, the engine is claimed to give far more satisfaction than the high-speed engine.

Archibald Kenrick & Sons, Ltd.

A novelty exhibited by this well-known hardware concern was a range of electric cookers, fitted with "Chromalox" solid-type elements, both in the oven and in the hot-plates. These were dealt with at some length in the "Electricity for the Home" section of our last issue. A selection of small electric fires in various finishes and electric irons were also to be seen.

Parker, Winder & Achurch, Ltd.

Among this company's exhibits, which were not mainly electrical, were examples of "Parwinac" electrically-operated oil burners. We illustrate in fig. 50 a complete unit with one burner gun. This consists of a special blower directly connected to an electric motor of standard make, both being mounted on a substantial baseplate. The example illustrated has a pump incorporated but gravity feed can be employed. The oil passes through a specially designed valve at the end of which is a patent sprinkler cone. The small end of the latter extends over the end of the oil pipe, allowing air to enter the cone. This air strikes the conical film of oil as

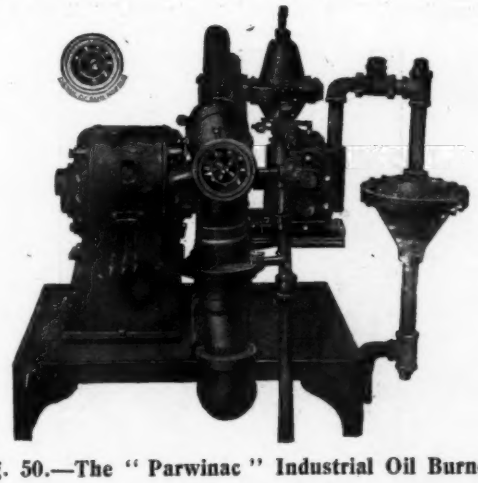


Fig. 50.—The "Parwinac" Industrial Oil Burner.

it leaves the valve; the oil is thus pre-atomised and deposited on the inner surface of the cone which, rotating at high speed, causes the oil to travel by centrifugal force to the larger end of the cone. There the sharp edge of the cone breaks the oil into minute particles which fly off and complete atomisation is obtained by the atomising air discharged around the spinner. The control equipment available includes thermostatic equipment for various situations and a magnetic by-pass gas valve.

Maestrophone Radio Gramophone and Wireless Co.

This firm demonstrated very ably the excellence of its electric radio-gramophones. Four models were exhibited, comprising a four-valve radio set, mounted above a dynamic speaker, a universal low-speed motor with speed control, and turntable, and well-mounted electrical pick-up. The cabinet work of these sets is very good, and the controls are of the simplest nature.

Fielding & Platt, Ltd.

This company's exhibit included two crude oil engines of 60 b.h.p. and 50 b.h.p. respectively, both of the electric lighting type. They are able to start from cold by the use of two sprays, one of which is designed to ensure certain starting, the other being of the low pressure type. The change from the starting spray to the working spray is carried out

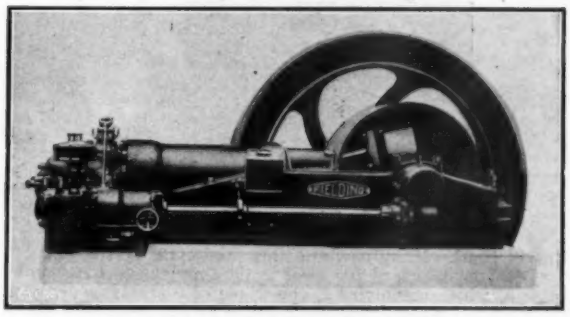


Fig. 51.—A Fielding Oil Engine.

automatically. The engines have been designed to use fuel suitable for Diesel engines, and are specially suitable for dynamo driving, being quickly started, and giving exceptionally steady running, the cyclical variation being within very fine limits. The accompanying illustration (fig. 51) shows one of the engines exhibited.

Midland Metal Spinning Co., Ltd.

In a very large display of aluminium and other ware this company included a number of electric bowl and bar fires, kettles, &c.

Curtis Manufacturing Co., Ltd.

This company had a comprehensive display of constant rated resistance apparatus for all purposes. Of interest to central station engineers was the meter testing board, which has been designed expressly for the purpose of checking the accuracy of supply meters. A complete range of sliding resistances were also on view. Other apparatus included arc resistances for single arc, and with patent duplex control for two arcs, as illustrated in fig. 52, a kinema control panel, furnace regulating resistances, motor starter speed regulators, charging panels and resistances, and a new and improved type of con-

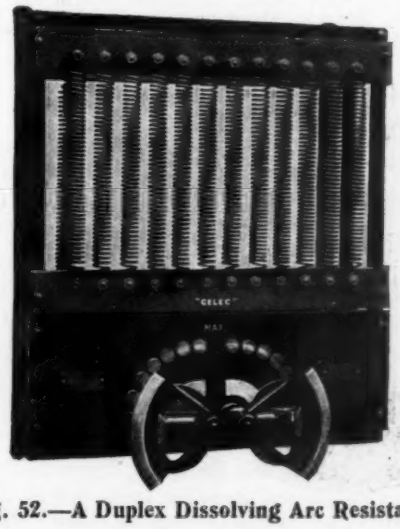


Fig. 52.—A Duplex Dissolving Arc Resistance.

stant rated theatre dimmer, incorporating the ball slide, a recently patented device, on the slide rod. This device, which was demonstrated for the first time, has been developed essentially to overcome the one slight disadvantage which has hitherto attended sliding type resistances of large capacity (1,000 to 5,000 watts), *i.e.*, the stiffening or tendency to bind of the brush on the slide rod, generally the result of incorrect or no lubrication. It overcomes the friction of the slide rod, and presents an almost frictionless movement.

Ray Engineering Co.

The exhibits on this company's stand included a new all-steel enclosed-type switchboard which was shown for the first time. The switchgear shown conformed in the main, with the company's standard design of quick-break knife type, the switches being built up in individual units as illustrated (fig. 53) and mounted behind sheet steel panels. The switches are mounted upon bakelite bases, and operated by means of bakelite insulated toggle links, terminating in an insulated handle passing through an escutcheon plate in the sheet steel

Fig. 53.—A Quick-break Knife-type Switch.

panel front. Many new and improved types of the controller type of switchboard for electric lighting plants were shown, one of which accomplishes the whole of the various switching operations by the turning of a single knob. Open-type switchboards, battery charging resistances, and a new type of telpher-crane or foot-operated ironclad switch is also shown.

Alpha Electrical Apparatus Co.

A wide range of electrical domestic appliances were shown on the stand of this company, including water heaters of geyser and storage types, fires, irons, kettles, towel rails, wash boilers, sterilisers, &c. An item of interest was an electric iron which has no mica in its construction. The element consists of a beaded insulated helix laid in grooves arranged in the soleplate, and the plug pins are fitted in special insulating blocks, the whole being mounted on a bridge fixed to the base, so that the cover of the iron is entirely separated from the plug pins. An automatic kettle was also known, fitted with a snap action power thermostat, fixed through the bottom of the kettle. This operates a switch which is opened at a pre-determined safe temperature. The switch remains "off" until the temperature is reduced by time or cold water added, when the thermostat operates and closes the switch. This thermostat operates on a.c. and d.c. supply. The storage water heaters exhibited were fitted with the company's patent elements, arranged horizontally in the cylinder in numbers according to the loading, the same type of thermostat being fitted. The cylinder of these has been specially designed to meet foreign competition, the copper is tested to 120 lb. per sq. in. to work up to 60 lb., and the galvanised iron 180 lb. per sq. in. to work up to 90 lb. One of these heaters is shown in fig. 54. Electric geysers made in sizes from 1½ to 12 kW were also shown for domestic and industrial use. A flow meter

Fig. 54.—An "Alpha" Storage Water Heater.

Fig. 55.—The "Ewbank" Electric Washer.

is used as a protective device against damage being caused by the heater left on circuit when the water has been turned off; this acts as a relay to operate a contactor. The elements are insulated by mica from the copper tubes carrying the water and they are arranged in 1 kW steps, so that the heat can be connected to two- or three-wire or three-phase supply.

Entwisle & Kenyon, Ltd.

A new type of electric clothes washer made its *début* on this stand. This washer (fig. 55) has a large-capacity tank in which a reciprocating perforated drum for holding a goodly quantity of linen is fitted. This drum is equipped with a friction clutch drive which slips if the drum should be overloaded, and thus protects the motor. The motor and the driving mechanism are totally enclosed and the lubrication arrangements are very efficient. A wringer of rather larger size than usual (16-in. rollers) is provided, and the control of this is automatic. A handle governs the direction of rotation, and when it is released the rollers immediately stop. As an additional safeguard a simple release device is fitted. When not in use the washer can be completely enclosed to form a table.

The Hackbridge and Hewittic Companies.

The Hackbridge Electric Construction Co., Ltd., and the Hewittic Electric Co., Ltd., exhibited together. A special feature of the stand was a display of a large number of drawings and photographs illustrating the latest developments in transformer and rectifier equipment. The stand itself was close to the Fair sub-station, which was equipped with mercury-arc rectifiers manufactured and supplied by the Hewittic Co.; the sub-station was open for inspection by interested engineers on application at the companies' stand. A representative selection of smaller types of mercury-vapour apparatus and descriptive literature was available on the stand, and samples of the patented "Hackbridge" thermal relay were also shown.

Herbert Morris, Ltd.

This company showed a model inside, and an actual example outside, of one of its petrol-electric cranes. The capabilities of this crane within a small compass are very remarkable. It can revolve on its centre on a circle equal in diameter to the wheel base and can travel in any direction. A forward or backward movement can be changed quickly into a direction at right angles by means of a screw gear which turns the wheels inwards. With the load as a centre, the crane can be made to revolve completely round it. In all circumstances the driver retains absolute control, for the response to his movements is immediate. Three sizes are produced rated at 9/20 cwt., 15/50 cwt., and 35/100 cwt.; the safe load, of course, varies with the radius and is indicated by a pointer and dial on the jib.

Morecambe Electrical Equipment Co., Ltd.

Several examples of food-preparing machines appeared on the stand of this company, including butchers' mincing machines and "Non-Fayl" coffee grinders. The latter are fitted with a regulating device permitting granulation in 20 grades. A universal motor is employed, and the equipment is of excellent finish. In addition, the company exhibited some small motors and switchgear.

F. Parks, Ltd.

In an enclosed stand this company had a varied display of highly-artistic lighting fittings in a number of materials. This included examples of floor and table standards covered in damask, &c., of lacquered Chinese design, and in polished mahogany and oak. Many lamp shades were shown in "Crystallene," "Nacrolaque," "Celastoid," "Rhodoid," and

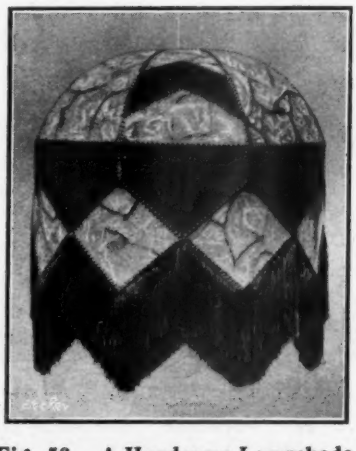


Fig. 56.—A Handsome Lampshade.

silk, with printed and hand-painted designs. One of these shades is illustrated in fig. 56. Other notable features were Chinese vases mounted for electric lighting, with shades to match and large shades made up from old prints, suitably treated. Window and showroom lighting fittings in "Crystallene" were also shown.

Victory Valves, Ltd.

This company's exhibit consisted principally of valves and boiler mountings. Among the equipment were examples of "Victory" patent electric valve control gear, an illustration of which appears in fig. 57. This shows the gear applied to a 10-in. bore junction valve for 400 lb. per sq. in. working pressure, with the cover removed. The employment of this gear enables the operation of the main control valves of a large steam-raising plant to be centralised. The gear has

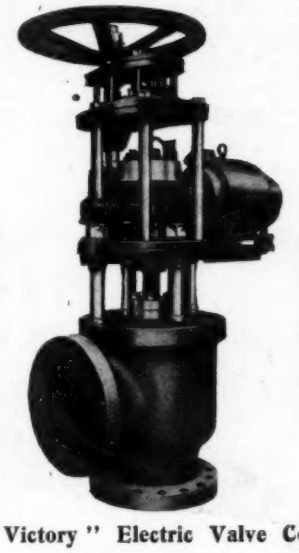


Fig. 57.—"Victory" Electric Valve Control Gear.

been designed to give definite positive action in opening and closing the valve, together with simplicity and safety, mechanically and electrically.

Young Accumulator Co. (1929), Ltd.

Many examples of its batteries were displayed by this company, the bulk of them being batteries standardised by leading automobile manufacturers, &c., among them being a standard "Bentley" battery and examples of those employed by Daimler Hire, Ltd. The company claims that the paste which is used for the positive plates, produced by a special process, increases the necessary chemical reactions and prevents the formation of sulphate. For this reason it is stated that greater capacity is obtained at all rates of discharge. It is also claimed that the prevention of the formation of sulphate allows a greater discharge without lowering the e.m.f. of the cell and renders it possible to use the battery for the self-starters of omnibuses and heavy commercial vehicles. The company maintains that its batteries can be charged at very high rates without shortening their life or impairing their efficiency. Some of the cells shown, notably for some radio work, were filled with the company's "Dri-Power" electrolyte, a jelly form which is said to be equal in efficiency to liquid acid.

Allen-Liversidge, Ltd.

As in previous Fairs, this company included in its display examples of electric welding and allied equipment. This included a "Pontelec" spot-type welder and a rivet heater, as well as a portable petrol-driven arc-welding set. Many examples of welded material were shown.

Sure-Arc Electrode Co.

Samples of welded joints and a display of its arc-welding electrodes appeared on this firm's stand. It is claimed that the flux covering of these electrodes ensures a homogeneous weld, effects a certain control over the flowing metal, and reduces porosity to a minimum. One type shown was an asbestos and flux-covered electrode with a very thin wire of special composition designed to act as a de-oxidising agent.

John & Joseph Taunton, Ltd.

A novelty in the way of electric heating was demonstrated in this exhibit. Several fire curbs were shown, each fitted with electric heating elements in different fashions. For instance, in one case elements were arranged in curved nickel-plated reflectors fitted on the rear face of the curb; in another heating bars were placed across the angles of the curb; while in yet another case "sausage" heating lamps were let into the top of the curb and were protected by wire guards.

Gledhill Brook Time Recorders, Ltd.

A complete and interesting display of time recording and cost checking devices formed the exhibit of this company. The Gledhill Brook "Clipper" recorder is a good example of a modern time recorder. This is a card machine which the worker operates on "arrival" and "departure." Every manufacturing process or operation can be timed in the same simple manner, and various systems of checking and costing can be combined with this one machine. The company also showed other models for simple time checking of workmen, or clerical staff, also for registering time on dockets, waybills, cost cards, &c. All these models print the exact minute, hour and day, and also distinguish between a.m. and p.m. time.

Messrs. G. H. Gledhill & Sons, Ltd., who are associated with this company, showed several models of their cash tills.

Heatly-Gresham Engineering Co., Ltd.

This company had on show examples of its "Rational" oil engines. One, coupled to a 9-kW "Aston" generator, provided energy for lighting the stand, &c. Another, rated at 2 b.h.p., was shown driving a 1-kW generator, the result being a very compact lighting set for country houses, yachts, &c. The engine is designed to give its normal output at 1,200 r.p.m., but it is capable of giving 2¼ b.h.p. at 1,200 r.p.m.

Willis & Bates, Ltd.

This exhibit was mainly a non-electric one, but it included several models of "Pellon" electric radiators produced by British Domestic Arts, Ltd., Halifax. This type of radiator has already been described in our pages. Briefly, the design is as follows:—The heating element is concealed beneath a dome mounted on a circular base forming a concave reflector. Air enters upward through the centre, passes over the element, and is directed downwards upon the concave surface of the base, and is widely distributed. The metalwork is most ornate, and several finishes are available, including chromium plating.

Chesterton, Jones & Co., Ltd.

This company exhibited a complete range of domestic electrical appliances, including its latest pattern cookers, notably a "Davidson" junior model suitable for small families. An extensive display of "Davidson" electric fires was on view, ranging from designs in keeping with the most artistic furnishings to models suited to less ambitious dwellings. Examples of the "David" electric iron in many shades of vitreous enamels and in nickel plate were shown. Among them was a pretty 1-lb. iron suitable for gift purposes and for travelling. Another novel appliance was a combined lighting and heating fitting shown in fig. 58. This is designed for use in bathrooms. The lighting unit is of the enclosed opal shade type, and the heating arrangement consists of an inverted bowl fire suspended from the fitting by means of three chains, which can be adjusted to the most suitable height. A small plug is incorporated in the lighting unit and by simply pulling this out and disconnecting the chains the heating portion can be entirely removed. The appliances can be fitted in bathrooms which are only wired for a single light, thus obviating the necessity of special wiring. Where it is desired to have the heater on a separate control switch another model is supplied with a ceiling plate not incorporating a lighting fitting. The fact that these heaters are suspended

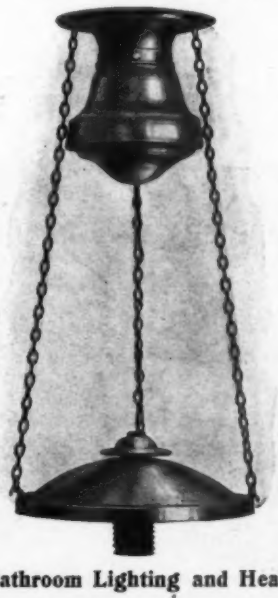


Fig. 58.—A Bathroom Lighting and Heating Fitting.

from the ceiling makes them perfectly safe for use in a small bathroom where it is difficult to fix safely any other form of electric heater. The heaters are supplied in nickel-plated finish, suitably protected by heat-resisting lacquer, and also in chromium plating.

The other exhibits comprised electric kettles, immersion heaters, storage tanks, hot-water urns, warming plates, and modern lighting fittings.

Commutator Grinding Block Co.

This firm claims to produce grinding blocks suitable for commutators ranging from that of a fan motor to that of a 20,000-kW generator. Its exhibit consisted of many examples of these blocks of various sizes and shapes for a variety of applications. The block material is made in four grades, the coarsest being designed for making large cuts, and the finest for finishing work. A great deal of ingenuity is shown in the shape and fitting of the handles of blocks for various purposes.

Record Electrical Co., Ltd.

The exhibits on this stand included the company's standard moving iron and moving coil switchboard and portable pattern instruments, also a typical range of "Cirscales." The portable series included a change coil test set, and a change coil combined double movement ammeter and voltmeter having six current ranges from 1 to 600 amps. and five voltage ranges from 1 to 750 V. A change coil multi-range ammeter having six current ranges only, from 1 to 600 amps., was also shown. A patented light weight bridge ohmmeter (fig. 59) was exhibited, which is interesting for its compactness, wide range and speed of operation. The set comprises an ohmmeter and a Wheatstone bridge with a testing range on the ohmmeter from 10,000 ohms to 100 megohms, and on the bridge from 0.01 ohm to 9.999 ohms. Tests can be made consecutively by the ohmmeter and bridge method by moving one switch, while the resistance under test remains connected to the same pair of terminals. The containing case is strong and has a handle for carrying. The Record "Cirscale" speed indicator was also shown. This has a clear open scale which extends over an arc of approximately 300 degrees. Other exhibits included r.p.m. indicators, complete with the necessary generators, for airships, engine rooms, &c.

Fig. 59.—A "Record" Bridge Ohmmeter.

British Sangamo Co., Ltd.

A very comprehensive display of electricity meters appeared on this company's stand, of the watt-hour and ampere-hour types. These were so exhibited as to show their internal construction and mode of operation. The patterns on view included all types of house-service meters (d.c. and a.c.) as well as switchboard types.

Thermo Path Co., Ltd.

The feature of this company's exhibit was a new electric fire which is designed for a maximum efficiency at a moderate price by eliminating anything elaborate in the way of ornamental construction. The framework is of steel, finished in crystalline black enamel, and the reflector is aluminium alloy. The loading is 2½ or 1¼ kW, in two stages. The fire is illustrated in fig. 44.

Fig. 60.—A New Electric Fire.

Exhibits at Olympia, London.

Dowsing Radiant Heat Co., Ltd.

As usual, a varied and interesting display was made by this concern, prominent in it being a range of "Solarium" electric sun baths (including a new folding pattern for household use), ultra-violet-ray lamps of portable and standard types, and other electro-medical instruments. The electrically-heated sterilisers for hospital use are now fitted with an improved form of automatic cut-out operated by a float. Another section of the stand was devoted to examples of "Hotpoint" cookers, hot-plates, domestic and laundry irons, bath-water heaters, radiators, and radiant bowl fires. Prominent among the latter was the pattern illustrated in fig. 61, with the copper bowl set in a cast frame finished either in stoved black, white, armour bright, or oxidised copper. Electric kettles, saucepans, copper urns, glue pots, sealing-wax heaters, soldering irons, the "Hoover" vacuum cleaner, and the "B-Q" electric fan-operated air ozoniser were also included in the display.

Fig. 61.—Framed Radiant Bowl Fire.

Hailwood & Ackroyd, Ltd.

Specialists in electrical glassware for both indoor and outdoor use, this firm had on view a number of new artistic designs of wall fittings and pendants (fig. 62). Attractive patterns of table lamps were also displayed, including one designed by Sir Frank Baines. It has a richly-chased solid bronze stand surmounted by a shade which takes the form of a globe built up of three layers of glass respectively frosted, opaque white and red glass, the layers being cut away to form a map of the world with British possessions standing out in red. Samples of "Hailux" heat- and cold-resisting glassware and of metal stampings and pressings for use in pendants and wall brackets were also displayed.

Fig. 62.—"Hailglass" Wall Bracket.

Peerless Electrical Manufacturing Co., Ltd.

An interesting range of electrically-operated appliances for the use of bakers and other classes of tradesmen was to be seen on this stand. Among the machines exhibited were dough and cake mixers and sausage and mincing machines. The various appliances are driven by small ball-bearing motors which, like the gearing, are entirely enclosed. Simple, yet reliable, means of starting and stopping the machines are provided.

J. J. Eastick & Sons.

"Eelix" terminals and other small components for use in connection with radio receiving sets and installations are available separately or made up in convenient cabinet form for display purposes by traders. Among the latest introductions shown were a special terminal for use in connection with all-mains receiving sets, and "Prods," a handy testing device consisting of a pair of metal points which are entirely shrouded when not in use, being exposed by finger pressure on the spring-loaded upper ends. The firm also makes useful two- and three-way lampholders.

M.L. Magneto Syndicate, Ltd.

This concern's stand was largely devoted to a display of its radio specialities, particularly to small d.c. to a.c. rotary transformers for use in connection with a.c. mains-operated receivers and radio-gramophones. Since last year an improved form has been introduced in which the commutator and slip-ring, instead of being arranged one at each end of the machine, are located at one end side by side; both sets of brushes can be readily inspected by a slight movement of one end-shield, while a small fan is fitted at the opposite end. The improved machine is being made in two patterns and in two sizes, one each for filament and anode inputs, with outputs of 40 or 85 VA. A range of anode convertors is intended to replace batteries in low-power transmitting sets and radio receivers.

George Nobbs, Ltd.

Prominent at this stand was a range of the Walker electric fires of artistic design, fitted with special bar elements. "Genii" tubular heaters for rooms, cupboards, &c., were displayed, also immersion heaters in single-, double-, and four-bladed patterns, wash boilers, distillers and sterilisers, foot and bed warmers, geysers, and calorifiers fitted with patented thermostats.

Pertrix, Ltd.

A range of dry batteries (now of British manufacture, produced in Redditch) is being made in all sizes suitable for use in connection with radio receiving sets, for flash lamps and torches; long life is claimed for them by reason of the fact that a special electrolyte is used. The firm also makes accumulators under the same name.

Read Radio, Ltd.

In addition to the "Reaco" receiving sets and radio-gramophones, this firm displayed a range of small accumulators made by the Jelectro Laboratories, the unspillable feature of which is obtained by the use of a "solid" electrolyte resulting from the addition to the sulphuric acid of a pink liquid known as "Jelectro" in the proportion of one part by volume of liquid to three of acid, the mixture converting itself within from five to six hours into a jelly. The batteries are available in capacities ranging from 8 to 40Ah, actual.

Staines Kitchen Equipment Co., Ltd.

This company showed in operation an electrically-driven crockery washer designed for use in hotels, restaurants, and large institutions. The machine, which cleanses plates, cups and saucers at the rate of 2,000 per hour with the minimum of manual attention, is provided with a series of brushes driven by belts off a 1-h.p. motor well boxed in to protect it from the water.

Zimbo Products (1929), Ltd.

Much public interest was shown in the "Lecco" stimulator, a device for applying a massaging effect to any part of the body. It consists merely of a G.E.C. ¼-h.p. ball-bearing electric motor, the two ends of the shaft of which are connected to a long body belt.

Ideal Home Electrical Appliances, Ltd.

This is another firm which specialises in electro-medical appliances of all kinds, including the "Alpine" ultra-violet-ray radiation apparatus, fixed and portable violet ray, h.f. "vitalators," ozonisers, massaging instruments, hair dryers, &c.

Electric Lighting Fittings.

A feature of the London Section of the Fair was the large number of firms exhibiting lamp shades made of a wide variety of materials and colours, including parchment, "Nacrolaque," "Celastoid," "Velskin," "Vetroloid," "Rhodoid," silk, and vellum. Among them were Albion Shades, Ltd., Artistic Lampshade Manufacturers, Electric Art Shades (1928), Ltd., Ellis, Simpson & Saunders, F. Parks, Ltd., John Pope, Speights, Ltd., and Waite & Son, Ltd. Cresswell P. Day, Ltd., in addition to ordinary shades of "Dayzoid" and "Nacrolaque," are specialising in shades made in a collapsible form, so that they can be packed in small compass for export. British Metal (Kingston), Ltd., included several examples of pierced metal shades with parchment and "Nacrolaque" linings. Some artistic designs of antique brass electric lighting fittings were to be seen on the stand of the Pearson-Page Co., Ltd. In the glass section a notable display of electric lamp shades and wall fittings was that of John Walsh Walsh, Ltd. Glass shades and lustre pendants were also shown by the Gray-Stan Art Glass Co., John Moncrieff, Ltd., and the Stourbridge Glass Co., Ltd. Included in a varied display of "Pyrex" glassware by James A. Jobling & Co., Ltd., were specimens of insulators for use in connection with radio-telephone broadcasting stations.

J. M. Newton Vitreo-Colloid (1928), Ltd.

At this stand were to be seen a variety of samples of a non-inflammable substitute for celluloid known as "Vitreo-Colloid." It is transparent, the basic material being cellulose acetate, and it is being used for a variety of electrical purposes, including the production of lamp shades.

The Radio Section.

Although not fully representative of the trade, one of the largest sections of the London Section of the Fair was that devoted to radio apparatus, chief interest in which was centred in many new types of all-mains receivers, improved loud-speakers, and combined radio receivers and gramophones. In the last-named section the exhibitors included, among others, Celebrity Gramophones, Ltd.; Continuous Gramophones, Ltd.; Earnshaw Bros. & Booth; Edison Bell, Ltd.; Itonia Gramophones, Ltd.; Eric J. Lever (Trix), Ltd.; Lissen, Ltd.; Merrington Bros., Ltd.; Micro-Perophone & Chromogram, Ltd.; Whittingham, Smith & Co.; and Thompson, Diamond and Butcher.

In recent years the Igranic Electric Co., Ltd., has devoted increased attention to the production of radio apparatus, a representative collection of which was displayed. Prominent on the stand were three patterns of mains-operated receivers, which include a unit supplying ample anode and filament-heating current for the valves. Another new introduction is the "Neutrosonic" short-wave receiver, a six-valve set with only three controls designed for wave bands between 12½ and 70 metres. Apart from complete instruments, the firm had on view a range of such components as variable condensers, resistances, and transformers, among which were several specially produced to meet the high-temperature conditions of tropical countries.

In addition to examples of its radio receiving sets and radio-gramophones, Cookes Wireless, Ltd., displayed the "W.A.C." accumulator charger, by means of which cells can be charged from the lighting and starting battery of a motor vehicle. The apparatus is made for use in connection with 6- or 12-volt circuits, and comprises a special low-resistance bulb which limits the charging current to 1 ampere, the input terminals being designed for connecting to the instrument board of a car.

Other exhibitors of radio apparatus included E. K. Cole, Ltd.; the Formo Co.; Halcyon Wireless Co., Ltd.; Neophone Engineering Co.; Ormond Engineering Co., Ltd.; Rees Mace Manufacturing Co., Ltd.; Stratton & Co., Ltd.; Truphonic Radio, Ltd.; and the Waverley Wireless Co. Electrically operated gramophones were shown by Collaro, Ltd. The motor is directly connected to the turntable and designed for any voltage between 50 and 250 V, combined with an adjustable resistance and an automatic electric stop.

Miscellaneous.

The Garrard Engineering and Manufacturing Co., Ltd., whose main product is spring motors for gramophones, is now making a small electric motor for similar use. It is a universal machine for d.c. or a.c. circuits, ranging from 100 to 250 V, the machine being provided with a tapped resistance for adaptation to any desired voltage. Edward MacBean and Co., Ltd., had a varied display, which included samples of oiled silk and cotton insulating materials for the electrical trades. "Eclipse" permanent magnets were among the articles shown by James Neill & Co. (Sheffield), Ltd. On the stand of Cambridge, Owen & Co. were samples of "Dielex" electrical insulating composition. Nameplates and terminal marking tabs made of celluloid are among the products of Cascelloid, Ltd., while the United Chemical Engraving Co., Ltd., is a specialist in the production of chemically-engraved nameplates in "Ivorine," celluloid, and ebonite. Corfield, Ltd., displayed condenser scales in metal, copper anodes for large radio transmission valves, and enamelled wire of a number of gauges. Samples of plating chemicals and of "Oasis" accumulator acid were to be seen on the stand of the General Chemical and Pharmaceutical Co., Ltd. Spencer, Chapman & Messel, Ltd., also included battery acid in their display of chemicals.

Electrically-illuminated, daylight, and other advertising signs were shown by, among other concerns, the Acme Showcard Co., Ltd.; the Allan Manufacturing Co.; the Attracta Electrical Co.; British Motorsign Co., Ltd., and the Strand and Interchangeable Signs, Ltd. Electric kinema projectors, science and advertising lanterns, and kindred apparatus was displayed by Newton & Co.; Ross, Ltd.; and James Swift and Son, Ltd.

Current Electrical Development.

Extracts from Remarks made in Opening a Discussion at the British Industries Fair, Birmingham.

By H. WILLOUGHBY-ELLIS, A.M.I.E.E. (President: Electrical Contractors' Association).

IN arriving at some conclusion concerning the future prospects of electricity supply in this country, it is necessary to consider the one outstanding mistake of the past. I refer, of course, to the lack of standardisation.

Due to lack of knowledge, but far more to lack of vision, we have set up a multiplicity of supply systems in this country which represent a standing reproach to our business acumen.

In spite of the labours of the Electricity Board and Electricity Commissioners, immense areas are even now being developed at pressures varying between 200 and 250 volts, and every day that passes renders any final readjustment all the more difficult, costly, and damaging to achieve.

The causes that have set up this chronic diversity of pressures and systems include the development of supply systems under individualistic views which were governed by what, for the moment, appeared to offer the best prospects in limited areas. Standardisation at fifty cycles will involve the expenditure of millions of pounds, but the position might never have arisen if we had studied the methods which had, even then, been definitely adopted by a large majority of Continental and American undertakings.

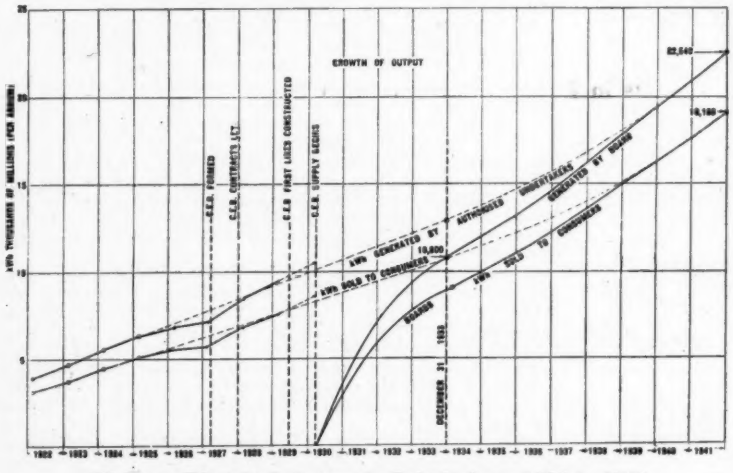

GROWTH OF OUTPUT
C.E.B. FORMED
C.E.B. CONTRACTS 1ST
C.E.B. FIRST LINES CONSTRUCTED
C.E.B. SUPPLY BEGINS
KWH GENERATED BY "AUTHORISED" UNDERTAKERS
KWH SOLD TO CONSUMERS
KWH GENERATED BY C.E.B.
KWH SOLD TO CONSUMERS
22,540
19,400
14,160
DECEMBER 31
1922 1923 1924 1925 1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936 1937 1938 1939 1940 1941

Fig. 1.—Electrical Output in Britain from 1922 to 1941.

Despite these adverse factors, however, the progress of electricity supply has been little short of phenomenal.

Those who have read "The Electrical Industry of Great Britain" (B.E.A.M.A.) will agree with me that this compilation represents one of the most illuminating semi-official publications of recent years. It is packed with an astonishing mass of important statistical information. It is immediately apparent, for example, that the electrical industry in this country has an immense leeway to make up before the degree of general electrification prevailing on the Continent and in America is attained.

In this country, industry takes 64 per cent. of the electricity sold by public undertakings; but, even so, the room for further expansion of the industrial load is very large indeed. The total capacity of all electric motors in this country in 1912 amounted to two-and-a-quarter million h.p. In 1924 the total was nearly eight million h.p., the degree of industrial electrification in this country then standing at about 51 per cent. In the United States, however, industry was electrified in 1909 to the extent of about 25 per cent., while by 1927 the degree of electrification had advanced to 78 per cent. Germany presents similar development; in 1907, 19.5 per cent. of all manufacturing machinery was driven by electric motors, while in 1925 this degree of electrification had increased to 66 per cent. To raise the British standard to the level already achieved in Germany would involve the installation of an additional two million h.p. of motors, while a further two million h.p. (in all, some twelve million h.p.) would be absorbed in raising British industry to the desirable maximum of efficiency visualised in B.E.A.M.A.'s compilation.

So far as main-line railway electrification is concerned, the future definitely holds very great possibilities indeed. It is not necessary for water power to be available in order to cater for this load. Steam-produced electricity is employed in Germany, Switzerland, France, the U.S.A., South Africa, and India for large and successful main-line railway schemes, and it is clearly apparent that the grid will place the whole question, in this country, on an entirely new basis, as the cost of new power stations will not have to be considered.

What will *not* disappear with equal certainty, however, is the "vested interest" which the railway engineer has in his steam locomotives, but the lesson already provided by the substantial electrification of the Southern Railway cannot be ignored. The experience of the Southern Railway has already supplied sufficient data, economic as well as technical, to prove that electrification has more than justified itself.

In attempting to gauge the work and effort that lies ahead of us, however, we must avoid undue concentration on the industrial load. In seven years the percentages relating to power, domestic, traction, and other uses have very considerably altered. Thus the percentage represented by power has declined 10 per cent. (possibly affording a measure of our recent industrial troubles); lighting and domestic load has increased by 50 per cent., while traction has fallen by 10 per cent., indicating, possibly, the increasing use of petrol-driven public vehicles.

Similar American statistics for 1927 allocate 61 per cent. to power, 29.2 per cent. to lighting and domestic, and 8.3 per cent. to traction, and the B.E.A.M.A. suggests that, under full development, the following proportions will be reached in Britain: power 61 per cent., lighting and domestic 29 per cent., traction 7 per cent., other supplies 3 per cent.

Elaborating this table and, once again, basing calculations on American statistics, it is suggested that the limits of electrical production during the next twelve years may be (in millions of kWh): industry 15,500, commercial 4,500, domestic 3,400, agriculture 720, traction 2,400, other purposes 2,000, total 28,520.

The wisdom of placing the general conditions prevailing in this country and in the U.S.A. in one and the same boat is doubtful. On the domestic side, for example, it has been shown that, in 1927, the American domestic load absorbed 29.2 per cent. of the electrical output in that country, while it is not anticipated that we shall in the next ten or twelve years (having already achieved a domestic absorption of no less than 24.6 per cent.) exceed the 29 per cent. already attained on the other side of the Atlantic! And this, in face of the acknowledged fact that the domestic load has increased in this country during the *past* ten years by no less than 50 per cent.

(Mr. Willoughby-Ellis showed a hitherto unpublished graph, fig. 1, showing the achieved and anticipated output from 1922 up to 1941.)

In this country, where a few degrees of frost to-day may be followed by hours of warm sunshine to-morrow, sole reliance on central heating systems never has achieved, and never will achieve wide acceptance, and we must address ourselves very seriously to the problem of providing really convenient installations and trouble-free equipment. The plug outlet question is of vital importance, and simple all-in rates *must* be provided. It muddles the whole electrical proposition to have some sockets providing current at one rate and other sockets supplying current at a different rate.

High flat rates for lighting were adopted to enable supply authorities to deal with the serious peaks of the pre-war load curve; but with an ever-developing daylight load (and I hope, a night load for water-heating) they are becoming less and less applicable.

Given economic rates of supply and sound and dependable equipment, the next immediate problem confronting us is the electrical education of the public. We find in the schools of this country that every scheme of domestic heating and cooking is handsomely represented, except the electrical. Is it not vitally necessary for the best brains in the industry, *not outsiders*, to pool their experience and ability in order to achieve a substantial measure of immediate reform? Indeed, the need for all sections of the electrical industry, the need for all electrical men of vision and goodwill, to come more closely together in some central "Council of the Industry" is daily becoming increasingly apparent. We cannot continue to develop our own respective sections of the industry without regard to our common welfare and our national progress.

Continuing the discussion, Mr. Ellis agreed with Mr.

Willoughby-Ellis that there was need for discipline in the industry, and Mr. Furse (Nottingham) pointed out that a difficulty sometimes arose because power companies were often reluctant to extend their mains unless they felt they were going to get loads. Municipalities, instead of extending the mains, often interfered with questions of wiring; they did not train apprentices, and the result was that they often got the worst class of workman. The tendency for local authorities to sell apparatus too cheaply, in order to stimulate the sale of electricity, operated very unfairly on the contractors.

Mr. A. E. Reynolds (Birmingham) said the author had quoted various percentages, but, to get the correct view of the position, they must be guided by the kWh sold. The suggestion had been made that power companies were reluctant to extend their mains on speculation, but he did think that was a general policy. He believed that rural electrification could be undertaken successfully. It seemed to him that the domestic load should be stimulated as much as possible, because the power load developed almost automatically. The introduction of current for lighting almost invariably meant its use for other purposes. The possibilities with regard to water heating by means of thermal-storage systems were very great. They should spread the gospel of the electric home, and engineers and contractors should practise what they preached.

Mr. W. R. Rawlings (London) said the discussion was specially important because the points raised in it had come at the right moment. In our variable climate electricity was the most convenient form of domestic heating, but we had to be sure that the supply could be given without any complications. He believed the time had come when the return wire should be put solid to earth.

Mr. E. J. Jennings (Birmingham) said that it was only to be expected that a high flat rate should be charged for lighting purposes only. For years he had been advocating that the various departments of the industry should get together and see what could be done for the industry as a co-operative whole. Many of the electrical contractors were apathetic, and he hoped steps would be taken to influence the non-members of the Contractors' Association in this particular matter. Birmingham, he added, had shown great activity with regard to the extension of mains for the benefit of domestic consumers. He believed they had not yet touched the fringe of domestic electrification.

Mr. Stretton (Cardiff) thought immediate attention should be given to the standardisation of domestic appliances.

Mr. Donovan (Birmingham) contended that whilst they pushed the sale of products that were now available they should also be in the position to provide the necessary accessories to consumers.

Mr. Justus Eck said that whilst lighting might provide only a poor class of load, improvement could be made if more attention were devoted to the matter of illumination, a bad example of which was given by the General Post Office.

Mr. H. Willoughby-Ellis briefly replied on the points raised, and to him a vote of thanks was passed on the motion of the chairman, Mr. J. Wilson.

Continental Electrical Industry.

A Review of Developments in Poland, Germany, and Austria.

Electrical Manufacturing in Poland.

An interesting article upon the Polish electro-technical industry appeared in the January issue of the *Polish Economist*. In the introduction it showed how German and Austrian influence predominated in Polish electrical affairs prior to the war, an influence which was assisted by the fact that young Polish engineers were forced by circumstances to secure their education abroad, mostly in Germany. During the war the Polish industrialists endeavoured to save their works from destruction, but, in Russian Poland especially, plant was removed to Russia and Germany and works and power stations were completely destroyed. After the war the unification of the Polish territories created a natural market for the products of local industries, and there were great possibilities for the electrotechnical industry. Preliminary work, aiming at the electrification of the country and the development of the electro-technical industry, was taken up by the Government, which registered works and passed the necessary legislation; by trade organisations, which studied the requirements and elaborated plans for the protection of the industry's interests; and by industrialists, who investigated the establishment of works for the production of electrical machinery and apparatus which was not manufactured in Poland. In the course of the Polish-German Customs war the Polish electrotechnical industry was protected in its early years, and it developed very rapidly in productive capacity and variety of output.

A number of powerful foreign concerns established on a sound financial basis and equipped modern plants, in order to avoid the payment of Customs duty and also in order to take advantage of the cheaper labour. In this way a number of establishments engaged in the manufacture of machinery and electrical apparatus, cables and electric lamps were called into being. With the gradual development of electrification, electrical power stations were built in steadily growing numbers, and due to a favourable policy and facilities for electrical installations, the consumption of electricity increased at a considerable rate. The last few years have marked an enormous progress in the growth of the production of the electrical manufacturing industry, despite the shortage of capital and foreign competition. Polish factories have hardly been able to cope with the demand made upon them, although extensions have constantly been made.

At the present time, after ten years of existence, the electrotechnical industry includes the following: 14 plants producing machinery and electrical apparatus, 11 works making installation accessories, 9 cable and wire works, 12 factories producing batteries and cells, 10 making lighting fittings and advertising signs, 4 electric lamp factories, several factories for accumulators, telegraph and telephone apparatus, electro-medical apparatus, and meters, and a number of electrotechnical porcelain factories. The radio branch has reached a high standard of development, producing practically all the articles in this line.

At the present time Polish plants produce three-phase motors up to 1,150 h.p., 6,600-V generators up to 1,000 kVA, transformers and convertors up to 37,000 V, and 1,600 kVA special traction motors with controllers, railway lighting installations, h.p. and l.p. switchboards, installation accessories, &c.

The value of the products manufactured in 1928 is estimated at 85 million zloty (£2,000,000 approx.). The industry employs about 10,000 workmen. To give an idea of the consumption of electrical articles in Poland, it is stated that the value of imported articles is about 75 million zloty (£1,700,000) per annum. About 60 per cent. of the imports come from Germany.

The industry employs modern scientific methods, and such questions as rationalisation and standardisation are given the utmost attention. It is believed that the electricity supply industry of Poland will develop considerably during the next few years, bringing more and more work to the electrical manufacturing industry.

The German Siemens Companies.

The report of the Siemens and Halske Company states that the turnover during 1928-29 experienced a considerable increase, although the degree of activity in individual departments was again subject to great fluctuations. Where a falling off did occur, especially in recent months, this was due not to the lack of requirements, but to the difficulty of customers to raise funds. The share of other countries in the total turnover again increased, although often at prices which were not very satisfactory. The deliveries of telephone and telegraph appliances to the Reich Postal authorities remained on the level of those in the previous year, but they were far from reaching the level of those in 1926-27; on the whole they amounted to 13 per cent. of the total turnover. In the telephone branch, good development took place with private customers, both in Germany and abroad, and automatic exchange plant for 47,000 connections was supplied to Italy. New telegraph apparatus was developed, including that for photo-telegraphy, while an increasing sale was effected of apparatus for broadcasting, as well as loud-speakers. Business was active in telephone cables, Pupin coils, &c., and a number of orders for export were partly carried out and others entered in the books. The sales activity was developed on a broader basis, especially in the matter of small manufactures, the result being an increased demand on the capacity and consequently on the organisation of the inland and foreign business offices. This development was facilitated by the combination of the management of the company and of the Siemens-Schuckert Works.

The Siemens-Schuckert Company reports that it increased the turnover in 1928-29 with industries which were not affected by the general economic decline, particularly through deliveries to European and overseas countries. The extension of the manufacturing works was practically completed. Besides producing new types of high power oil and quick-break switches for nominal currents up to 6,000 amps., the Siemensstadt switchgear works had also produced large oil-free switches. The construction of turbo-generators was transferred to the Mulheim works, while large rectifiers were developed.

In the central station department the year was characterised by the completion of large works, which included the long-distance transmission installation of the Rhenisch-Westphalian Electricity Company, which for the first time employs a pressure of 220,000 V without the earthing of the neutral point; the erection of 60,000-kW transformers, and new types of oil and separating switches for 200,000 V; and the Ruth steam storage plant with a capacity of 40,000 kW for the Charlottenburg electricity works. Orders for convertors and motor generators were complemented by orders for phase displacers. Many contracts for large rectifiers of 4,000 to 6,000 A were received, while the cable branch showed satisfactory progress.

Austrian Trade and Industry.

Mr. A. S. Phillpotts, O.B.E., Commercial Secretary at Vienna, has prepared for the Department of Overseas Trade a report upon the economic conditions in Austria, revised to November, 1929 (Stationery Office, 2s. net). In the course of this it is stated that 1928, the tenth year of the new Republic, was the best year the country has had so far, from the point of view of economic development. In both 1927 and 1928 there were surpluses in the national finances, largely due to the regular growth of the reports from direct taxes, which is an indication of the general improvement in the condition of the country. Capital expenditure in 1928 amounted to £6,100,000, of which £1,270,000 was allocated to the electrification programme west of Salzburg, which is now nearly finished, and £2,220,000 to the State undertakings, chiefly to the Post Office for overland telephone cables and the introduction of automatic telephones. Two years ago it was proposed to raise a new loan of £20,000,000 to finance a programme of improvements to the railways, telegraphs and telephones and other public works, but delays in receiving the necessary sanction occurred and unfavourable conditions arose in the money market. During 1929 money was raised abroad by two Austrian electrical concerns. The Styrian Water-Power Company sold $3½ million of 6 per cent. bonds at 82½ per cent. in Italy; and the Elin Electric Company raised £220,000 in London on 7½ per cent. bonds at par.

On balance, Austria is an exporter of electrical goods. In 1928 her exports of "electrical machines and apparatus, electro-technical necessities" were valued at about £2,120,000 against £1,850,000 in 1927. Austrian imports of the same class had a value of £1,450,000 in 1928, as compared with £1,150,000 in 1927. Full details of Great Britain's share of this trade are not given but it is shown that in 1928 Austria supplied over 3,000,000 lamps valued at £118,000 to this country, while we were also large customers for Austrian radio apparatus, taking 49 metric tons out of a total of 200 tons in 1928 (more than double our share in 1927). Great Britain supplied to Austria only 4 metric tons of the 863 tons of electrical goods imported, but the figure represented a satisfactory increase. Germany and Switzerland were the chief suppliers of the 76 tons of radio apparatus imported in 1928; Great Britain supplied only 3 tons, Germany and Holland dominating this trade. Austria has exported electrical equipment and water-power plant to Russia.

The report reviews the progress made in the harnessing of the country's water power. Only 55,000 h.p. has been added to the total development in the past two years, but already the supply available is more than sufficient for Austria's needs and the sale of electricity to Germany is consequently increasing. German finance has participated in the exploitation of Austrian water power, notably in the case of Ill works in Vorarlberg. The present development amounts to 170,800 h.p., equivalent to a yearly output of 1,003 million kWh, but construction is in hand, chiefly in Vorarlberg and the Tyrol, which will add 113,900 h.p. (667 million kWh annually). Further large undertakings are projected, two of which involve the harnessing of the Danube and represent 150,000 h.p. each. A still more ambitious project is the "Tauern" scheme in the province of Salzburg which aims at developing 2,100,000 h.p.; the power generated would be transmitted to North and Central Germany. It is stated that a scheme has been prepared by one of the leading German electrical manufacturing companies; it would take ten years to complete and preparatory work may start in 1931. A number of other schemes are said to be likely to be undertaken before long.

Rural Electrification in New Zealand.

An outline of successful technical practice and of the "service" and financial assistance which the Power Boards extend to consumers in country districts.

(*Extracts from a discourse before the* Overhead Lines Association.)

Mr. W. P. GAUVAIN explained that, with a population of under 1,500,000 and an area equal to that of Great Britain, electricity was supplied in New Zealand to 91 per cent. of the population in the areas where it was available, the consumption per head of population in those districts being 398 kWh per annum. That extensive development was due to a number of factors, the chief of which were (*a*) the placing on the Statute-book of the Electric Power Board Act, (*b*) the enthusiasm and co-operation of farmers, (*c*) the fact that in the majority of cases the occupiers of farms were also their owners, and (*d*) the service and financial assistance which the Power Boards had extended to consumers.

The country was wonderfully endowed with water power, which could, in most cases, be developed at costs comparing favourably with those of schemes in other parts of the world. The amount of water power capable of development was approximately 700,000 h.p. on the North Island and 4,000,000 h.p. on the South Island, on the basis of a 50 per cent. load factor, without including schemes of 1,000 h.p. or under. The granting of water-power rights had not been viewed with favour by the Governments; consequently the State developed the main schemes and local bodies were granted powers to arrange for the distribution of electricity so produced, which, in effect, was what the Electric Power Boards Act passed in December, 1918, provided for.

The Act provided for the creation of elective Boards whose duties were to arrange for the distribution of electricity in their individual areas; they were empowered to raise loans for distribution, generation, and trading purposes, and for financially assisting consumers. The Boards had rating powers over their districts and the rates were pledged as security for the loans raised to carry out the schemes, whilst in the case of the income of a Board not being sufficient to pay outgoing expenses it had the power to levy rates to make up the deficit. The Act also made provision for losses in the early stages by allowing Boards to carry forward any losses to be repaid at a later date. The Power Boards were co-operative concerns, relying on the support of the individual ratepayers to make them financially successful, and any accrued profits were returned to the ratepayers in the form of a reduction in the charges for power. Development, following the introduction of the Act, had been such that in 1927 New Zealand was sixth on the list of electrified countries as regarded consumption per head of population, with 310 kWh per capita.

The Government, as a general rule, established and operated the generating stations, but in a few cases Power Boards whose areas were remote from the Government main transmission lines had been granted licences to develop their own supplies. The main transmission lines operated at 110,000 volts. The main sub-stations were provided by the Government and supplied electricity to the Boards at 11,000 volts, except in a few cases in which conditions necessitated the use of a higher pressure, when supplies were given at 22,000 and 33,000 volts. The charges for power at each point of supply were as follows:—

£2 10s. per kVA of maximum demand per quarter for the first 200 kVA.

£2 from 200 up to 5,000 kVA, and £1 15s. for all above 5,000 kVA.

Special terms were, however, quoted for large blocks of power. There was no kWh charge.

It was customary for the Boards to erect their distribution lines along the roads, but whenever it was found necessary to run lines across country it was of rare occurrence that any payment was asked for by landowners for wayleaves. Due to the attitude of the farmers, therefore, the wayleaves problem was a simple one. The majority of the poles in use for distribution lines were imported Australian "Ironbark," or other Australian hardwoods. Some of the Boards, with a view to supplying their own requirements in the future, had started plantations and obtained the necessary advice from the Government Forestry Department. Reinforced-concrete poles were not in use to any great extent, owing to their comparatively high initial cost. For the main transmission lines the majority of the supports were steel, but for distribution lines it was not often economical to use that material. For lines operating at 11,000 volts a minimum clearance of 20 ft. between any portion of the line and the ground was stipulated, so that for double-circuit lines at that voltage it was customary to use poles of a length of 35 ft. and for single-circuit lines poles of 30 ft. In both cases the height was

sufficient to allow of the erection of low-voltage lines on the same poles at a distance of 4 feet below the high-voltage lines. High-voltage telephone lines, where required, were erected on the same crossarms as the low-voltage power lines.

The conductors were chiefly hard-drawn stranded copper. For voltages of 3,000 V and over stranded wire only was allowed to be used, with a minimum size of 7/.064, whilst for low-pressure the minimum size was No. 8 S.W.G.; for service lines No. 10 S.W.G. galvanised-iron and steel wires were used to a moderate extent, more particularly in areas where there was no anticipation of any great increase in load, whilst copper-covered aluminium and steel-cored aluminium were also in use, but on a small scale. The standard low voltages were 415/240 at a frequency of 50 cycles. Although 3,300- and 6,600-volt lines were in use to some extent, the tendency now was as the result of experience to concentrate on 11,000 V for the distribution pressure. Apart from the main sub-stations, which controlled large areas, the switchgear of which was housed in concrete buildings, the ordinary sub-station was of the pole type and rose in capacity from 3 up to 100 kVA. In the case of the smaller sizes the transformer and switchgear were accommodated on a single pole, but in that of the larger sizes two poles spaced about 7 ft. apart were used. In the latter case the transformer platform was about 13 ft. above ground level and the equipment consisted of a switch and fuses placed above, and well clear of, the transformer, low-voltage fuses, and whatever measuring apparatus might be deemed necessary. Lightning-arrestor apparatus was placed on terminal stations, but it was not considered necessary to afford any such protection to transformer stations at intermediate points. The high-voltage switchgear was operated from the ground level and kept locked, one key being capable of opening all padlocks in any particular area.

Where a large number of transformers was in operation over an extended area maintenance was important, and some Boards used lorries, which were in commission for eight or nine months in each year, equipped with the necessary apparatus and carrying supplies of oil, travelling from station to station for testing and filtering oil; some were electrically driven and had sleeping accommodation for two attendants.

So far the use of electricity on New Zealand farms was limited, probably due to climatic conditions; it was chiefly confined to the driving of milking machines and cream separators, pumping water and, to a smaller extent, shearing. In addition, extensive use was made of water heating in the milking sheds, whilst the purely domestic load consisted of lighting, cooking, water heating, and the usual labour-saving appliances. The paramount difficulty was the capital cost of installation, and it was in that respect that the Boards, by financially assisting consumers, were of considerable help to prospective consumers, who were usually required to pay one-third of the cost of the installation in cash, the balance being spread over a period of three years. The Boards had trading powers and to a great extent they carried out complete installations with their own staffs, the resulting profits going to swell the funds of the undertakings. For successful country electrification effective "service" was essential, and the arrangements were such, so far as the milking load was concerned, that if a motor failed during milking a spare one would be installed in time for the next milking. In March, 1929, there were 10,200 electrically-driven milking machines and a further 8,000 driven by other methods. In the milking sheds electricity was largely used for heating the water required for cleansing the machines and utensils. The element was connected to the circuit through a double-throw switch, so that the heater was not in use when the milking motor was running; the electricity for that work was not metered, but was charged for on a flat rate varying from £6 to £8 per 1,000 watts per annum, equivalent to from 0.26d. to 0.35d. per kWh during the time the heater was in operation. The sizes of the milking-machine motors varied from 1 to 3 h.p., but by far the greater number was of 2 h.p., and the rate was a fixed charge per h.p. of connected load, plus a kWh charge. The average cost worked out at from 3d. to 4d. per kWh, and at those figures it was possible, when taking total costs into consideration, to compete with the petrol engine, which was almost universally employed prior to the introduction of electricity. There was still room for the extensive development of the domestic load in rural areas, more particularly in the use of cooking appliances; electric cookers had been installed by 7.6 per cent. of the consumers and water heaters by 11 per cent.

Power was used by dairy factories, quarries, saw mills, flax mills, brickyards, freezing works, and sundry industries. The combination of the supply to those undertakings with the domestic and farming loads enabled a high average annual load factor to be obtained; for all distributing authorities in 1929 it was 46.6 per cent., whilst several of the Power Boards had figures greatly in excess of that. The maximum charge for domestic lighting in rural areas was about 8d. per kWh. and for domestic power the rates started at 3d. per kWh and went down to 1½d. A number of Boards had minimum domestic power rates of 1d., but the 1½d. rate attracted cooking loads in the country areas.

As an indication of the results which might be attained in a typical rural area, the following details from the annual report for the year ended March 31st, 1929, of the Thames Valley Electric Power Board were quoted. The Board controlled an area of 2,300 square miles, containing a population of 40,800, or an average of 17.7 persons per square mile. The largest town had a population of under 5,000 and there were three towns of approximately 2,000 inhabitants each, together with a number of villages. Power was also supplied to 22 dairy factories, 9 quarries, 3 saw mills, 3 flax mills, and 2 Government workshops. The motors in use totalled 2,593, of which 1,798 operated milking machines; 352 were used for general farm work, and 448 for industrial purposes. There were 1,278 circuit miles of distribution lines and 424 miles of service lines. The revenue was £98.4 per circuit mile. The total capital expenditure was £720,600 and the revenue £125,792, or 17.5 per cent. of the capital expended. The number of transformers in use was 437, having a total capacity of 11,219 kVA, or an average of 25.7 kVA per transformer. The maximum demand on the system was 5,220 kVA, the annual load factor 66.1 per cent., the power factor 0.933, and the energy sold per head of population for the year 486 kWh. Consumers numbered 6,968 and the revenue per consumer was £18.05, or per head of population £3.08, whilst the revenue per kWh sold was 1.52d. The energy sold per route mile of distribution line totalled 28,700 kWh. Capital charges amounted to 47.5 per cent. of the total cost, purchase of power 33.1 per cent., and management, distribution, and maintenance 19.4 per cent.

The capital expended by the Government on hydro-electric schemes up to March 31st, 1929, amounted to £8,468,000, whilst the expenditure by Power Boards only, exclusive of other supply authorities, totalled £12,010,000. Some 43 Power Boards were constituted, of which 38 had distributing powers. After paying interest and sinking fund charges on the capital expended, together with operating and maintenance charges, the profit amounted to £100,500. The total length of distribution lines of all supply authorities was 17,760 route miles, the number of consumers per route mile was 15, the maximum power demand 8.15 kilowatts, and the sale 30,600 kWh, producing a revenue of £211.

The relationship between the Boards and the Public Works and other Government Departments, such as the post and telegraph services and railways, was a happy one and was fostered by the appointment of standing committees, which met periodically and by annual conference at which all debatable points were fully discussed. The regulations regarding the supply of electricity were periodically reviewed and not modified until the Boards had had the opportunity of placing their views before the Department.

It was gratifying that most of the electrical plant installed in the Dominion was of British manufacture, and the Boards were most anxious that that state of affairs should continue.

Discussion.

Mr. R. Borlase Matthews said that undoubtedly thermal storage was one of the things that would help in obtaining a good load factor.

Mr. W. A. Turnbull (Aylesbury) said that success in New Zealand appeared to be largely due to assistance in the matter of wayleaves and the absence of obstruction in that connection, together with the fact that a fairly high price could be obtained for electricity in competition with oil, as compared with this country. Again, 17.5 per cent. return on the capital expenditure was sufficient to make the scheme pay there, whereas it would be on the tight side in this country. As regarded transformers, he personally did not go below 10 kW, and there was not much difference between the costs of 5-kW and 10-kW transformers.

Mr. T. F. Christie suggested that as New Zealand was nearer the equator than England there would be a more uniform lighting season throughout the year, with longer nights in summer and relatively shorter nights in winter than in England. That might affect the load factor over the whole year.

Mr. Bentham believed the Electricity Commissioners in this country would soon be pressing supply authorities to hire out apparatus at uneconomical rents, suggesting that they should expect their return from the supply of electricity to make up for the deficiency in that respect.

Major Theodore Rich (hon. secretary) said it seemed that success in New Zealand was primarily due to the fact that they had given attention to the right end, *viz.*, distribution. The increasing use of 11,000 volts as a main distribution pressure was a step in the right direction. A great deal of harm was done by talking about extra-high pressures, because when people heard that an extra-high-pressure line was to be erected in their neighbourhood they immediately imagined that something extra dangerous was to be put up.

Mr. A. T. Scott said that there did not appear to be any continuous earth wire, or bonding, of the steel work where the crossarms were. In this country he imagined they would have to bond the steel pins with a continuous earth wire, which would complicate matters and add to the cost, although bakelised wood might be used for the pins and for the crossarms. The latest development in this country was to place the fuses on the transformer terminals, so that the fixing of the fuse was done as a composite part of the transformer.

Mr. Napier Prentice said it seemed that they had a better "electric idea" in New Zealand, probably because they were not so hampered by regulations and had more assistance from the Government.

A number of other speakers asked the author numerous questions.

Mr. W. P. Gauvain, replying to the discussion, found it difficult to say how far New Zealand practice could be applied in this country. The milking load had been cultivated there, and he wondered why it had not been developed in Britain;

there were 18,000 milking machines in use in New Zealand and no farmer with 20 cows, or more, would think now of adopting the old method of milking. The average size of water-storage tank in the milking sheds was from 10 to 12 gallons and the load was a simple one to handle, because the water was only required at certain times during the day, and during the intervening period heating was going on. In houses the tanks were of about 30 gallons capacity, being switched on for two hours in the morning and two hours in the evening, off the peak load. The elements were usually of from 750 to 1,250 watts.

The price obtained for electricity was not so high as might seem at first. The charge for milking was from 3d. to 4d. per kWh, and for water-heating 0.3d. per kWh, so that if the two were taken together the average for the milking shed would be about 1d. per kWh. Although farmers used to complain that the price was high, in comparison with the cost of running an oil engine, it was found that the comparison was made without taking into account the cost of repairs, spare parts, and the cartage of the petrol from the railway station. As to the 17½ per cent. return on the capital expenditure being rather low, the Power Boards were not out to pay large dividends. All they had to do was to pay interest, sinking fund, and depreciation charges, and none of the Boards were allowed to raise money at a higher rate than 5½ per cent. without the special permission of the Minister of Finance. Very few 3-kW transformers were in use, and only a few on 11,000-volt lines. They rather liked to group farms together and use a larger transformer. An air-break switch was used, and the fuse, which was made in New York, was known as the S. & C. type. In New Zealand it was almost always dark by 8 o'clock in the evening, even in the summer time, and 10 kWh per month was a good lighting consumption of farm premises. The low-voltage supply was at 415/240 volts. People in New Zealand seemed to like to feel that they owned the apparatus and for that reason hire-purchase had been cultivated.

The cost of lines varied considerably in different places, but a single-circuit 11,000-volt line could be put up for £300 per mile, and in some cases for considerably less. The three-phase four-wire lines going to farms cost £120 to £240 per mile, according to the condition of the ground and the amount of copper in the line. The metering was done by a true kVA-meter. There had been no trouble through people being able to obtain access to the lines and apparatus. Automatic circuit breakers were used on some of the bigger poles, unfortunately of American origin, but some were being sent out from this country now. There was no earthing wire on the wooden poles and the steel parts were not bonded; earthing was, however, carried out at the transformers and guards. As a matter of fact there was some difficulty in getting a good earth, as so much of the ground was pumice. Continuity of supply was well maintained, and the chief trouble in that respect was caused by branches and leaves of eucalyptus trees falling across the lines. On the local lines the continuity of supply was 95 or 96 per cent. The proportion of the total supply used for power purposes was considerably higher than in this country for rural purposes. The percentage loss was, on the average, about 17 or 18 per cent. All the timber used for poles was Australian and the crossarms were tallow wood, which was Tasmanian. There had been some trouble from poles leaning, because some of the dairying country was swamp land, and in those circumstances the poles were heavily blocked. There had been quite a lot of trouble from salt deposition on insulators on the main Government lines and also on some of the other lines not far from the coast; the only cure seemed to be to wipe the insulators down. So far as the individual installations were concerned, they were earthed at every transformer platform and also to water pipes or earth plates on the premises themselves. It was not the usual practice to earth milking machines, neither were the pins of insulators earthed.

Mr. Turnbull said he was using single-phase transformers instead of three-phase up to 50 kW and had found them cheaper.

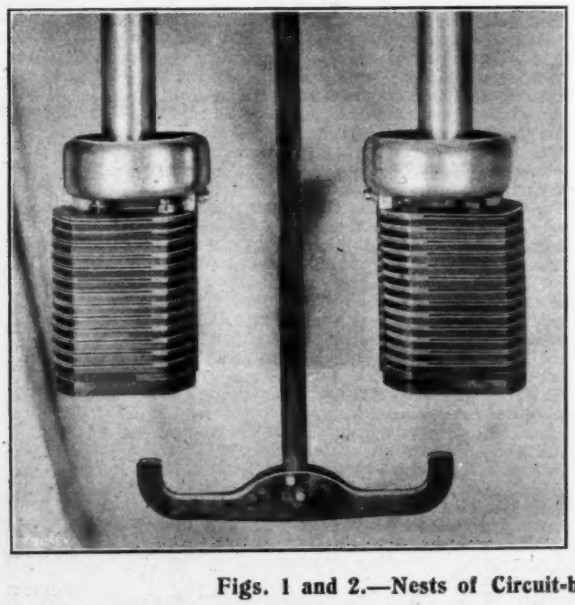
Mr. Gauvain said that one or two of the Power Boards originally adopted single-phase transformers, but now practically everyone used three-phase transformers for the reason that they had come to the conclusion that their cost was less. All the distribution was three-phase. Actually the single-phase motor for milking purposes cost about three times as much as the three-phase machine, in small sizes.

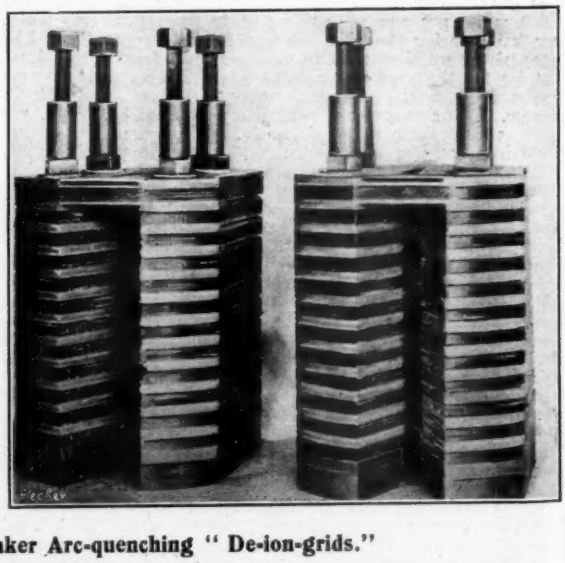
The President, Mr. T. Stevens, suggested that Mr. Gauvain might be induced to read a paper on this subject at the agricultural meeting in the summer.

"De-ion-grid" Switchgear.

American engineers claim to have discovered a method of utilising the gas formed on drawing an arc in oil, usually regarded as detrimental, as the means of reducing the length of the arc to a fraction of that hitherto required for rupturing the arc.

THE oil in which the circuit-breaking contacts of large switchgear are immersed, a petroleum product specially refined for the purpose, is generally assumed to serve the double purpose of quenching the arc drawn as the electrodes part and acting as an insulating medium to prevent flashing across the electrodes after they have parted and the circuit has been disconnected. In the case of very serious short circuits almost unlimited power may flow in the circuit at the time the circuit-breaker opens, and the interruption of the flow of such large power in a fraction of a second represents the dissipation of an enormous amount of energy in the oil. The absorption of that energy safely in the shortest





Figs. 1 and 2.—Nests of Circuit-breaker Arc-quenching "De-ion-grids."

possible time is the problem all circuit-breaker designers attempt to solve.

The drawing of a heavy-current arc in oil results in the generation of a considerable quantity of gas, due to volatilisation of the oil in contact with the intense heat of the arc. The phenomena accompanying arc extinction in oil have, in the main, been regarded as a necessary evil to be endured because no other method of switching was available; in the event of a prolonged arc, sufficient gas may sometimes be generated to produce a dangerous pressure in the arc-rupturing chamber.

The American Westinghouse Electric and Manufacturing Co. claims to have lately discovered a way of utilising the gas so generated to extinguish the arc in a very much shorter time than has been possible hitherto. The amount of gas formed by an arc in oil is dependent on the length of time during which the arc persists, so that by generating gas at an even faster rate for a short interval of time and by utilising it more efficiently, the company maintains that it has succeeded in decreasing the time of arcing, thus extinguishing the arc much more quickly than has been done heretofore, and therefore decreasing also the total amount of gas generated. Tests have been made with the new device, which extinguished an arc at less than 15 per cent. of the length to which it was formerly necessary to draw an arc in oil before it could be ruptured.

This marked improvement in performance is accomplished by means of small arc-quenching devices, known as "De-ion-

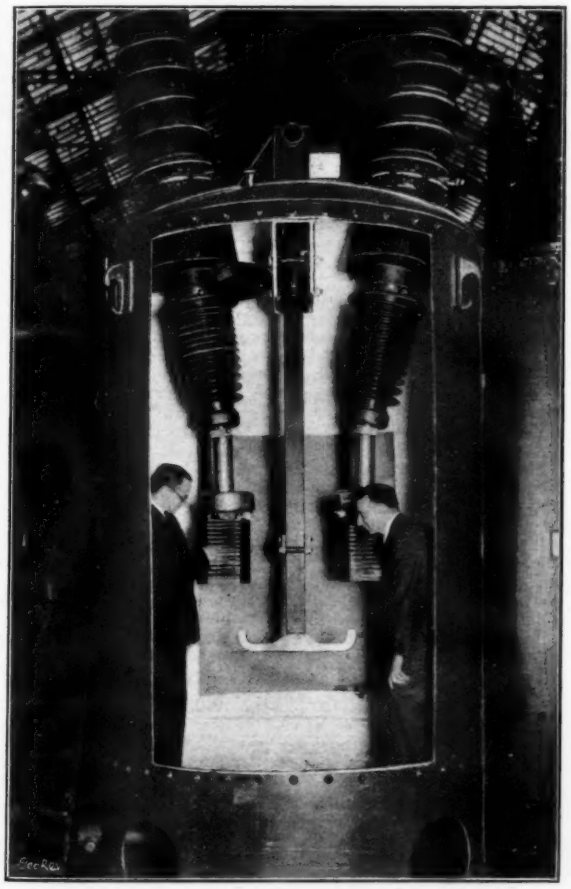


Fig. 3.—"De-ion-Grid" Circuit Breaker; Mr. B. P. Baker and Dr. J. Slepian.

Grids," located in the oil at the point where the electrodes separate and the arc is drawn.* In the grid is a deep and comparatively narrow groove, closed at one end, but open at the other; the length of the groove varies with the voltage of the circuit to which the breaker is applied. As the grid is located below the surface of the oil, a small portion of the oil body is entrapped within the groove. When the electrodes part, an arc is drawn near the open mouth of the groove and is moved toward its closed end through the action of a magnetic field produced by the arc itself acting on a suitable iron circuit. The movement of the arc against the entrapped oil in the groove keeps it in constant contact with fresh oil, the arc cutting its way through the entrapped body of oil in much the same way that an acetylene torch cuts a steel plate.

The intense heat of the arc causes the oil to be transformed into gas as the arc moves forward, and the gas (in order to escape) must pass transversely through the arc stream to the open mouth of the groove. The latter is so narrow in width that the arc occupies practically all of the space between its side walls and all of the gas formed must, accordingly, pass through the arc on its way to the open. It is this continual flow of fresh gas through the arc stream along its entire length that destroys its ability to conduct current and ruptures, or extinguishes, the arc in the shortest possible length of time. Thus, although the rate of gas generation is higher than that of previous oil circuit-breakers, all of the gas generated is used so effectively that the length of time during which the formation of gas is taking place is greatly decreased and the total amount of gas formed is very much less than in the case of normal circuit-breakers.

The "De-ion-Grid" is also very economical in the use of oil; for any one rupturing operation only a very small portion of the entire oil body is used, that portion which is entrapped in the groove at the time the arc is drawn. Immediately after the arc is extinguished, other oil rushes in to fill the groove, and to be used in turn for the next circuit interruption. In this manner only a small portion of the oil in the chamber is exposed to the deteriorating action of any one arc, and a breaker may be subjected to very much longer service than has been possible in the past before the oil needs to be changed. For instance, upwards of fifty short-circuit tests have been made on a single body of oil without any marked depreciation in its insulating value.

The development of this device would seem to set a new standard for high-voltage oil-immersed circuit-breaker performance, and is claimed to be a solution of the problem of providing safe, positive, and expeditious means of clearing faults on transmission lines and distribution networks.

The accompanying illustrations indicate the manner in which the arc grids are assembled and also the simple form of moving contact (fig. 1) which is shown lowered to the "open" position by the micarta lift-rod.

* See ELEC. REV. March 29th, 1929, p. 590, and Jan. 31st, 1930, p. 232.

Parliamentary News.

[By our Special Parliamentary Reporter.]

The Future of Wireless Telephony.

On February 26th Mr. BOWEN asked the Postmaster-General whether any decision had been reached as to the control of Imperial wireless telephony and whether it was intended to use the "Beam" stations.

Mr. LEES-SMITH replied that the Government had reached a decision. Under the late Government the Beam wireless system for overseas telegraphy was leased to the Imperial and International Communications Co. In conformity with the recommendation of the Imperial Wireless and Cable Conference, however, the Government reserved to the Post Office the control of overseas telephony and refrained from committing itself on the question whether it would or would not use the company's stations for this purpose. In August last he (the P.M.G.) received a letter from the Communications Co. urging that the Government should now decide to work overseas telephony through the company's stations, beginning with four services to Canada, Australia, South Africa, and India. There was one alternative. The other was to concentrate all the wireless telephone services at the Government station at Rugby, which had for three years worked the service to the United States on a commercial basis. In making a decision there were two main issues. First, which of the two systems would provide the more efficient service, and, second, which would be the more economical. As the first question involved highly technical considerations, the Government decided to consult two experts who had no connection with the Post Office—Professor G. W. Howe, Professor of Electrical Engineering in the University of Glasgow, and Dr. F. E. Smith, Secretary of the Royal Society and of the Department of Scientific and Industrial Research. They reported that apart from future developments both systems were probably equally capable of providing satisfactory communication between two points for a given number of hours a day, and that, as regarded future development, the Rugby system was the more elastic and therefore offered decided advantages. The second main issue was the financial comparison between the two systems. Concentration at Rugby admitted of economies in many directions, and, in particular, in the land-line connections to the London Trunk Exchange. By the grouping of services at one centre, a smaller number of lines would suffice and the distances of Rugby and Baldock from London were much less than the distances of the Beam stations at Bodmin, Bridgwater, Grimsby, and Skegness. To work the four services to India and the Dominions through the Beam stations would need 4,190 miles of high-grade telephone circuit, while to work them through Rugby and Baldock only 786 miles would be required. The minimum rental asked by the company for the use of the Beam stations for the telephone services was (excluding a cheaper scheme which was open to objection on other grounds) £40,000 to £45,000 per annum, according to the type of equipment em-

ployed, plus a royalty of 10 per cent. on the gross receipts in excess of a certain figure. A detailed estimate of the cost of working the same services from Rugby showed a saving on those figures of £17,000 per annum and £22,000 per annum respectively, which would be increased when the royalty commenced to operate. For these and other reasons the Government had decided to conduct overseas wireless telephony by concentration at the Post Office station at Rugby with its receiving station at Baldock.

Mr. Baldwin intimated that the Opposition would ask for a day for debating the matter.

Electric Traffic Signals.

On February 26th Mr. Day asked the Minister of Transport whether his recent reports from the provinces on the various systems of electric automatic traffic signals showed that they were meeting with great success; if similar experiments in the Metropolitan area were under consideration, and if he could give particulars.

Mr. Morrison said that the experiments made in the provinces with automatic traffic signals were generally giving satisfactory results, but it was important that the apparatus should be of a suitable type and that the signals should only be erected where the best results were likely to be obtained. Arrangements were being made to carry out an experiment with signals of this nature in Oxford Street.

A Scottish Case.

On February 26th Dr. Forgan asked the Minister of Transport whether he would take steps to expedite the introduction of electric light in the area of West Renfrewshire covered by the powers given to the Clyde Valley Electrical Power Company, particularly in the Kilbrachan and Milliken Park district, which had not yet been furnished with a supply.

Mr. Morrison said that the authorised distributors for the West Renfrewshire area, namely, the Strathclyde Electricity Supply Co., Ltd., were already providing supplies in each of the parishes included in the area of supply under their Order of 1925. With regard to the district specially mentioned, the result of a canvass made by the company a few months ago was not regarded as promising in relation to the capital expenditure necessitated for providing a supply in that district.

The Battersea Power Station.

On February 26th Sir Kingsley Wood asked the Minister of Transport whether he could state the present position concerning the Battersea power station; and whether he had received any further report on the matter.

Mr. Morrison said that he understood that the London Power Company hoped to complete early in March the experiments with a full-sized washing plant, and would then submit a further report.

Correspondence.

Correspondents should forward their communications as early as possible. ***No letter can be published unless we have the writer's name and address in our possession.***

Motor Users and the Frequency Change.

In your issue of the 14th instant Mr. Huggins deals in an able manner with the designer's problems in producing a satisfactory duel-frequency motor, but he concludes by making certain unfavourable deductions purely from an individual designer's point of view. I should like to submit the case as it works out in actual practice.

Mr. Huggins quite rightly draws attention to the question of efficiency, but he omits to state that the same remarks apply to all buyers of industrial electric motors, irrespective of the question of frequency change. It is now clearly recognised that dual-frequency motors can be, and are being, supplied in quantities that possess efficiencies equal to straight 50-cycle motors. In practice the vast majority of electric motor buyers do not care a fig for efficiency, and buy down to a price, not up to a standard; they do not even ask for efficiencies when buying. Moreover, if all buyers accepted or rejected motors on independent test figures, those who cut down their designs to the last limit would often be hard pressed to get their machines accepted, unless they lowered their present efficiency guarantees.

One important point to remember is that, in general, 50-cycle motors develop only about half the starting torque of corresponding 25-cycle motors; consequently, users may be faced with starting difficulties when the frequency change takes place, *e.g.*, where they are now starting up squirrel-cage motors on 25 cycles by the star-delta method, it may be necessary in some cases to change the method of starting to auto-transformer in order to obtain the necessary starting torque. The dual-frequency motor is equal to the straight 50-cycle motor in this respect, and if fitted with an auto-transformer starter at the outset the starting difficulty should not arise.

Dual-frequency motors, being built on a larger frame, are mechanically more robust than corresponding single-frequency motors, and are equal to the latter electrically. It has been argued that the larger frame is a disadvantage because it interferes with duplication of frames, whereas it is nothing of the kind, because makers use their standard frames; it is the frame size only that varies. If a dual-frequency motor breaks down the user can easily replace it by a spare single-frequency motor of the same frame size, but having a higher horse-power.

Re the paragraph headed "Performance and Reliability," the dual-frequency motor, as stated above, is not less efficient than the straight 50-cycle motor, and, in an actual recent installation of some 550 h.p. of 25/50-cycle dual-frequency motors ranging from 1 h.p. to 25 h.p., the efficiency of the installation is as high as would have been obtained by the replacement scheme. It is interesting to note that actually there is a slight total gain, by virtue of higher efficiencies at 50 cycles, of about 2 h.p., the saving being about £15 per annum over and above the 25-cycle consumption costs. If we capitalise this, it virtually amounts to a present from the Central Electricity Board of some £300, in addition to the amount actually handed over in cash by the supply authorities.

Yes, there are two sides even to this dual-frequency question.

Cycle.

February 24th, 1930.

In reply to "H" in the Electrical Review of February 28th:—

(1) The 25-cycle motors will be scrapped.
(2) We do not deal in second-hand motors, and the insinuating suggestion in question (3) does not therefore arise.

Crompton Parkinson, Ltd.,
T. H. Windibank,
General Sales Manager.

The City & Guilds Examinations.

I trust that you will allow me space to encourage installation engineers to sit for the forthcoming City & Guilds examination on installation work.

Encouragement is certainly needed, as in the past years there has been much complaint as to the nature of the papers, a complaint that the writer thinks is quite justified. The papers were above the grade of an installation engineer and of such a nature as could be more properly answered by an electrical engineer, being well above a wireman's standard.

This is now a tale of the past, as the examinations are this year being conducted under the new syllabus, a syllabus with which little fault can be found. The wireman and the foreman will therein find their needs fully met.

The time is approaching when contractors will see the benefit of employing qualified as well as experienced men, and sooner or later the certificate of the City & Guilds will be a necessity for the wireman.

The installation course at most technical institutions is of three or four years' duration, so it behoves the wireman to make an early start.

The *latest date* for entering for these examinations is March 10th, so there is no time to be lost before enrolment.

I am writing, not only as a teacher, but as an active contractor.

J. Peake Sexton, A.R.C.S., A.M.I.E.E.

London, S.W.11, *February 26th*, 1930.

Relative Costs of Electricity and Gas.

I should be very much obliged if one of your readers would kindly solve, without bias, the following problem:—

Which is the cheaper, c.p. for c.p.: electricity at 4½d. per kWh for lighting purposes or gas at 3s. 4d. per 1,000 cu. ft.? I require to know the actual comparison, irrespective of the advantages of either system.

Also, if this is not too involved, which gives up the greatest number of heat units usefully for a penny, an ordinary electric cooker with power at a 1d. per kWh or an ordinary gas cooker with gas at 3s. 4d. per 1,000 cu. ft.?

Arguer.

February 25th, 1930.

The Efficiency of Conversion.

Referring to the remarks of "D.T.J." on charging small batteries from a.c. mains, I feel sure that he will be well advised, both from electrical and financial points of view, to use a l.p. method of charging, bearing in mind the number of batteries he has to charge in a given time. The plant, perhaps, is a little dearer to install than other kinds, but it finishes its work in a shorter space of time, and hence will show a quicker return for the outlay. The l.p. method of charging also requires little attention after the batteries are connected up. When grouping cells for charging (*i.e.*, 2-V cells to 6-V cells) care must be taken to arrange them of the same Ah capacity to ensure as much as possible that they will reach the charge point together. If one cell in a group shows

itself to be charged before the remainder, it must be taken out of the group and another cell of a series resistance put in its place.

A. G. L.

March 1st, 1930.

Accumulator Charging.

We notice a letter in the ELECTRICAL REVIEW for February 21st regarding prices for accumulator charging. We have gone into this subject very carefully and enclose a card of our revised scale of charges. These charges cover the periodic inspection of the batteries whilst under charge and the necessary tests by hydrometer, &c., also topping up with distilled water. We consider the prices are an absolute minimum.

Guy V. Laycock, Ltd.,
H. P. RIPLEY,
Director.

Huddersfield, *February 24th*, 1930.

[The prices mentioned vary from 6d. for any 10-Ah accumulator to 2s. 6d. for a 120-Ah, 6-volt accumulator.—EDS. ELEC. REV.]

Mercury-arc Rectifiers.

We note that in the February 28th issue of your journal, in a footnote on a *résumé* of a paper read on mercury-arc rectifiers before the Rugby Engineering Society, it is stated that the glass-bulb rectifier is hardly competitive in large sizes, and that the bulb renewal cost of this type of equipment is high, the average life being given at about 10,000 hours.

We feel these statements were made under a misapprehension, as they are so far away from the real facts. Glass-bulb rectifiers have been employed in this country since 1922, and there are now several hundred installations, varying from 100- to 6,000-kW capacity.

In regard to bulb life, this is so much in excess of the figures quoted that, although hundreds of bulbs have been in operation for many years, users are still in the fortunate position of not knowing what the ultimate life will be, as practically all the original bulbs supplied with the equipments are still in operation. These facts can readily be checked by anyone interested, referring their inquiries to any users of glass-bulb rectifiers.

Hewittic Electric Company, Limited,
T. F. LISTER, *Manager.*

Hersham, Surrey, *March 3rd*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

25,172. "Quenching of sparks in spark-gaps of electrical switches and the like." S. Ruppel. September 1st, 1928. (Addition to 307,311.) (324,892.)
28,550. "Loud-speakers." L. Levy. October 4th, 1928. (298,168).
28,561. "Television and like apparatus." J. L. Baird and Television, Ltd. October 4th, 1928. (324,904.)
30,776. "Inter-valve coupling devices for speech-amplifying apparatus and the like." A. L. M. Douglas and G. E. Ward. October 24th, 1928. (324,942.)
31,544. "Reproducer units adapted to be actuated by a gramophone record for producing electrical impulses." Burndept Wireless (1928), Ltd., and J. H. D. Ridley. October 30th, 1928. (324,945.)
31,830. "Method of and means for separating desired from undesired electric currents." E. G. Gage. November 2nd, 1927. (299,852.)
31,979. "Apparatus for recording differences of electrical potential set up in a living body." C. C. Mason, W. J. Stallan, F. Doggett, and Cambridge Instrument Co., Ltd. November 2nd, 1928. (324,944.)
32,228. "Electrolytes for electric cells." L. A. Levy and Almelda Accumulators, Ltd. November 5th, 1928. (324,918.)
32,231. "Electric fires." Ferranti, Ltd., and S. Z. de Ferranti. November 5th, 1928. (324,919.)
32,266. "Television and like systems." J. L. Baird and Television, Ltd. November 5th, 1928. (324,949.)
32,433. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., W. H. Paulett, and C. Gillings. November 6th, 1928. (324,952.)
32,453. "Manufacture of moulded insulating bases for electrical switches and the like." J. A. Crabtree and J. R. Dolphin. November 7th, 1928. (Addition to 306,249.) (324,973.)
32,524. "Arrangement of sound transmitters and sound receivers on ships." Electroacustic Ges. November 25th, 1927. (301,073.)
32,542. "Electrical switches for motor-vehicle horns and other purposes." S. Wiseman and E. F. Tyler. November 7th, 1928. (324,953.)
32,544. "Telephone systems and apparatus for use therewith." J. E. Pollak (Associated Telephone and Telegraph Co.). November 7th, 1928. (Cognate application, 36,881/28.) (324,954.)
32,546. "Synchronising devices." J. L. Baird and Television, Ltd. November 7th, 1928. (324,955.)
32,625. "Primary electric batteries." A. N. Hazlehurst. November 8th, 1928. (324,981.)
32,648/50. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. November 8th, 1928. (324,982/4.)
32,651. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd., L. P. Lowry, and J. R. Hardwick. November 8th, 1928. (324,985.)
32,773. "Electric condensers." Standard Telephones and Cables, Ltd., and P. R. Painton. November 9th, 1928. (324,995.)
32,789. "Transformer connections." British Thomson-Houston Co., Ltd., and J. C. Read. November 9th, 1928. (324,999.)
32,864. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., C. Gillings, and W. H. Paulett. November 9th, 1928. (325,005.)
33,248. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and J. E. Outline. November 13th, 1928. (Addition to 265,633.) (325,019.)
33,763. "Thermionic amplifiers employed in conjunction with loud-speakers." J. L. Gottlieb & Co., Ltd., and J. L. Gottlieb. November 17th, 1928. (325,021.)
33,814. "Thermionic amplifiers." Gramophone Co., Ltd., and C. O. Browne. November 17th, 1928. (325,023.)
33,888. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. November 19th, 1928. (325,026.)
33,890 "Long-distance cable with compensation for electromagnetic cross-talk." Siemens Schuckertwerke Akt. Ges. January 17th, 1928. (304,229.)
34,791. "Vacuum electric tube devices." E. Y. Robinson and Associated Electrical Industries, Ltd. November 26th, 1928. (325,030.)
35,094. "Electric meters and wattmeters." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines a Gaz and A. D. Iliovici. November 28th, 1927. (301,398.)
36,236. "Electric irons." H. S. Nowell and C. H. Twigg. December 8th, 1928. (325,042.)
36,531. "Mercury-vapour rectifiers." General Electric Co., Ltd., and E. Weintraub. July 21st, 1928. (315,849.)
36,861. "Electrical condensers." A. E. White (Sprague Specialities Co.). December 13th, 1928. (325,047.)
37,815. "Field-magnet construction for dynamo-electric machines." F. Newton. December 21st, 1928. (325,056.)

1929.

734. "Electromagnetic vibratory devices for use, for example, in the recording or reproduction of sound." Gramophone Co., Ltd., A. Whitaker, and E. M. Payne. January 8th, 1929. (325,067.)
784. "Electric hand lamps or torches." J. Downs and Watts, Fincham and Co., Ltd. January 9th, 1929. (325,068.)
814. "Electric switchgear." G. Pailin and Ferguson, Pailin, Ltd. January 9th, 1929. (325,069.)
1,316. "Electromagnetic sound reproducer." Brandes, Ltd. June 12th, 1928. (313,483.)
1,517. "Protective means for electric motors." F. W. Highfield and Highfield Electrical Co., Ltd. January 16th, 1929. (325,077.)
1,635. "Holder for an electric lamp reflector or like device." Rowland's Electrical Accessories, Ltd., and F. H. Jenkins. January 17th, 1929. (325,078.)
1,962. "Support of lead-in wires inside of electron tubes." Dr. S. Loewe. January 21st, 1928. (304,601.)
2,839. "Telephone systems." General Electric Co., Ltd., G. A. Gow, and C. W. Wilman. January 28th, 1929. (325,084.)
2,857. "Single-phase transformers." International General Electric Co., Inc. January 28th, 1928. (Addition to 273,525.) (305,038.)
3,023. "Production of an electrical connection of high conductivity between a layer formed of a metal compound and a conductor." Siemens-Schuckertwerke Akt. Ges. February 1st, 1928. (305,171.)
3,028. "Photographic recording by electric discharge." Radiovision Corporation and A. G. Cooley. January 29th, 1929. (325,085.)
3,118. "Electric cut-out devices." S. Gilchrist. September 27th, 1929. (325,086.)
3,306. "Distribution of electric power at the working face of mines and similar workings." Siemens Schuckertwerke Akt. Ges. February 3rd, 1928. (305,221.)
5,009. "Electric incandescent inspection lamps." Hart Accumulator Co., Ltd., and F. H. Pearse. February 14th, 1929. (325,102.)
5,157. "Apparatus for supplying current to thermionic valves." V. G. Van Colle. February 15th, 1929. (325,107.)
5,421. "Electric hunter gears, particularly in racecourse and like totalisators." W. O. Heyne, P. J. Packman, and British Electric Pari-Mutuel, Ltd. February 18th, 1929. (325,111.)
5,426. "Glow discharge devices." Westinghouse Lamp Co. July 24th, 1928. (316,175.)
5,820. "Controllers for electric motors." Garrard Engineering and Manufacturing Co., Ltd., and H. V. Slade. February 21st, 1929. (325,121.)
6,389. "Apparatus for effecting the distant transmission and the reproduction of images." U. J. Thuau and H. Antranikian. February 29th, 1928. (306,961.)
6,961. "Electrical adapters of the multiple-socket type." A. P. Lundberg and Sons, Ltd., G. C. Lundberg, P. A. Lundberg, and G. Pegg. March 4th. 1929. (325,130.)
7,138. "Electric arcs for welding and like purposes." Presslicht-Patent-Verwertungsges. and E. Wist. March 5th, 1929. (325,132.)
7,469. "Watertight electric bells." A. Graham & Co., Ltd., and A. C. Brockies. March 7th, 1929. (325,134.)
8,127. "Electric immersion heaters." British Brass Fittings, Ltd., and A. Logan. March 13th, 1929. (325,140.)
8,324. "Methods of manufacturing dynamo-electric machines." British Thomson-Houston Co., Ltd. March 14th, 1928. (307,845.)
9,312. "Electric disengaging devices for warping machines for yarns or threads." E. Hochheimer. March 28th, 1928. (308,799.)
10,735. "Multi-core submarine cables with gutta-percha or like insulation." Norddeutsche Seekabelwerke Akt. Ges. and C. Traugott. April 6th, 1929. (325,157.)
12,636. "Vacuum or low-pressure metallic-vapour lamps." Dr. S. Von Bogdandy and Dr. L. Wamoscher. May 14th, 1928. (311,704.)
19,087. "Solid electric conductor, especially for high and maximum voltages." Metallges Akt. Ges. June 25th, 1928. (314,340.)
22,306. "Electron discharge devices." Westinghouse Lamp Co. July 31st, 1928. (316,579.)
39,848. "Manufacture of moulded covers for plug-and-socket couplings and adapters." J. A. Crabtree and J. R. Dolphin. November 7th, 1928. (Addition to 306,249.) (Divided application on 324,973.) (325,012.)
39,849. "Manufacture of moulded insulating parts of electrical fuses." J. A. Crabtree and J. R. Dolphin. November 7th, 1928. (Addition to 306,249.) (Divided application on 324,973.) (325,013.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from February 26th :—

C; British Construction and Design (lettering and design). No. 508,957. Class 6. Electric drills, vacuum cleaners, electric motors and generators, and similar electrical machinery and parts.—L. Murphy, trading as the Auto-Electric Co., Cordwallis Works, Maidenhead.

Noctophone. No. 509,474. Class 8. Apparatus for use in transmitting voice sounds, or images and scenes to a distance by telegraphy.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Hyronic. No. 509,901. Class 8. Scientific and philosophical instruments and apparatus for useful purposes.—Lissen, Ltd., Worple Road, Isleworth, Middlesex.

Wotan. No. 505,177. Class 13. Electric lamps (ordinary), and electric light fittings.—Osram Gesellschaft, Berlin. (British representatives: Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.2.)

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ADDINGTON (Surrey).—Shops, Selsdon Park Road and Addington Village Road; Addiscombe Garden Estates, Ltd. Aeroplane hangar; Horseley Bridge and Engineering Co., Tipton, Staffs.

AYLESBURY.—Additional 100 houses, for the T.C.; borough surveyor.

AYRSHIRE.—School, Cronberry, and extensions, Fenwick School, with electrical work, for the E.C.; William Reid, Education Offices, Ayr.

BANNOCKBURN.—Housing scheme (35), for Stirlingshire C.C.; clerk, Stirling.

BASINGSTOKE.—Housing scheme (40), for the T.C.; borough surveyor.

BEDFORD.—Houses (132), for the T.C.; C. A. White, builder. Schools (£50,000), for the borough E.C.; director of education.

BEESTON.—Elementary school (£45,500); Notts. E.C.

BEXHILL-ON-SEA.—Houses, Eastwood Road and Cooden Drive; J. E. Maynard, Collington Avenue.

BEXLEY HEATH.—Factory extensions, Gravel Hill, for Mandrews, Ltd.

BOTHWELL.—Reconstruction of Parish Church (£8,000); incumbent.

BRIGHTON.—Shops (5), Belvedere Terrace; Palmeria Mansions Estate Co. Shops, Lewes Road; Brighton Equitable Co-operative Society.

BURTON LATIMER.—Housing scheme (34), for the U.D.C.; surveyor.

BURY (Lancs.).—Concert pavilion, for the T.C.; John Chadwick, borough engineer.

CHIRNSIDE.—School (£16,000), for Berwickshire E.C.; director of education, Duns.

CHORLEY.—Houses (93), Springs Road; borough engineer. Hospital, Preston Road; Chorley Hospital governors.

COLCHESTER.—Laundry extensions, for the Colchester Steam Laundry Co., Ltd.; John Russell, managing director.

COVENTRY.—Technical college, for the borough E.C.; A. W. Hoare, architect.

CROYDON.—Houses (32), Spring Park estate; M. Brown and Co. (Bournemouth) Ltd., Richmond Chambers, Bournemouth. Town Hall extensions; Special Corporation Committee. Hangar, workshops, clubhouse, &c., for Aero Club, Lodge Lane; Henlys, Ltd.

EDINBURGH.—Restoration of Greyfriars Church (£25,000); the minister.

DAGENHAM.—Wesleyan church; trustees.

DERBY.—Block of offices (six storeys), St. Mary Gate, for Naylor, Sale & Woore, architects, Market Place. Conversion of Palais de Danse into skating rink, for T. Harley, London Road.

ELY.—Housing scheme (50), for the U.D.C.; G. A. J. Edmundson, architect, Silver Street (returnable deposit of £1 1s.).

EYEMOUTH.—School (£36,000), for Berwickshire E.C.; direction of education, Duns.

GLOSSOP.—Extensions, Charleston Bleachworks; John Walton, Ltd.

GUILDFORD.—Alterations and additions, North Street; Cow and Gate, Ltd. Sewage works (£51,000); Dodd and Watson, consulting engineers.

HERTFORD.—School, for Herts. E.C.; E. Longmore, clerk.

HIGH WYCOMBE.—Extensions, War Memorial Hospital (£11,000); secretary. Factory, Hughenden Road, for F. Williams.

HUDDERSFIELD.—Additional 339 houses, for the T.C.; borough architect. Extension of nurses' home; Huddersfield and District Queen's Nurses Association.

IRISH FREE STATE (Moate, Co. Westmeath).—New church of Corpus Christi, Mount Temple; T. F. McNamara & Son, architects, 5, Dawson Street, Dublin. (Returnable deposit of £5. 5s.)

KENT.—Schools (£1,347,443), for the E.C.; E. Salter Davies, director of Education, Maidstone.

LEICESTER.—Elementary school, Taylor Street (£26,676); J. Chapman & Sons, Ltd. Assembly hall and masters' house, Wyggeston School (£19,850); Smith & Hutchinson, Ltd. Library, West Humberstone; city engineer. Further extensions of Museum (£13,825); Albert Herbert, architect.

LINCOLN.—Extensions, including X-ray department, electric lift, and electric plant, County Hospital (£100,000); W. G. Watkins, architect, Silver Street.

LONDON (Shoreditch, E.).—Remodelling Haggerston Road school (£15,700); L.C.C. architect.

(Cricklewood, N.W.).—Garden suburb scheme, with 1,000 houses and shops; John Lang & Sons, Ltd., builders, Carlisle.

(Lee, S.E.).—Shops, High Road; J. Brown.

(Sydenham, S.E.).—Flats, Winchfield Road (£28,720); H. J. Higgins, architect for Lewisham B.C.

(Peckham, S.E.).—Reconstruction of Hollydale Road school (£17,179); J. & G. Bowyer, Ltd., Upper Norwood.

(Streatham, S.W.).—Memorial church; vicar of Holy Redeemer Church.

LUDDENDENFOOT.—Reinstatement of cotton and woollen spinning mills (£40,000); Lewis Whiteley & Sons, Ltd., Brick Mill, and Whitworth & Co., Ltd., Cooper House Mills.

MACCLESFIELD.—Houses (84), Moss Lane housing site, for B.C.; E. Hamson, borough surveyor, Town Hall, Macclesfield (returnable deposit of £2).

MAIDSTONE.—Extensions, stores department, for Kent E.C, (£30,000), county surveyor.

MANCHESTER.—R.C. elementary school, Victoria Avenue. Blackley; managers. Public washhouses, Gorton and Collyhurst; city architect, Town Hall.

MELTON MOWBRAY.—School (610 places), for Leicestershire E.C.; director of education, Leicester.

MERTHYR.—Extensions, Isolation Hospital (£16,500); borough engineer.

MILTON REGIS.—Additional 96 houses, for the U.D.C.; surveyor.

OLDHAM.—Council school (850 places), Limeside; buildings inspector, Education Offices, Union Street West (deposit £1 1s.).

OXFORD.—Church; Rev. W. H. Walsham How, vicar of St. Albans.

ST. HELENS.—School (1,000 places), Grange Park, for the borough E.C.; director of education.

SHIRLEY.—Houses (34), Barnfield Avenue and Shirley Avenue; Paish, Tyler & Crump, 1, Addiscombe Road.

SLOUGH.—Factory extensions, for Horlicks, Ltd.

SOLIHULL.—Housing scheme (50), for the U.D.C.; surveyor.

SOUTH ASHFORD.—Two central schools, for Kent E.C.; W. H. Robinson, Springfield, Maidstone (returnable deposit £2 2s.).

SOUTHPORT.—Technical and art school (£50,000), senior school (£36,000), and junior school (£24,000), for the borough E.C.; director of education.

SOUTH SHIELDS.—Housing scheme, East Jarrow; borough engineer. School (864 places), Cleadon Park; Education Committee.

STOKE-ON-TRENT.—Houses (40), off Milton Road, Sneyd Green; Shenton Bros.

SWADLINCOTE.—Houses (99), for the U.D.C.; R. F. Holton and Sons, builders.

SWINDON.—Isolation hospital extensions, for the T.C.; R. J. Beswick & Son, architects, 10, Victoria Road (returnable deposit of £2 2s.).

TORQUAY.—Technical school, for the Devon E.C.; county architect, 97, Heavitree Road, Exeter.

TUNBRIDGE WELLS.—Reinstatement of premises, The Pantiles, for the Marquis of Abergavenny.

TYNEMOUTH.—Development of Hawkeys Lane estate; Mr. Brannen.

WINDSOR.—Bank, High Street, for the National Provincial Bank, Ltd., London.

WREXHAM.—Centrifugal pumps and motors, Rossett drainage scheme, for the R.D.C.; engineer, Imperial Buildings, Regent Street (returnable deposit of £10).